FLIGHT

and The AIRCRAFT ENGINEER

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The Outlook

A Great Fighter

WHEN it becomes possible to view the first year of the war in perspective it will be found that Fighter Command of the R.A.F. has done incredible work in the defence of the country. That is not to say that the ground defences have not also played their part, nor that Bomber Command has not rendered equally vital service by striking at the enemy in his own country and in the countries overrun by him.

But it was to Fighter Command that fell the task of defending London and our provincial cities during the early part of the German air offensive, and it is to Fighter Command that we owe the failure of Germany to terrorise these cities. Truly, as Mr. Churchill said in his memorable speech, "Rarely have so many owed so much to so few."

The R.A.F. would be the first to admit that much of its success has been due to the excellence of the aircraft and engines with which it is equipped. And among the fighters the Hawker Hurricane has the distinction not only of having brought down more enemy aeroplanes than any other type (the figure is believed to be well over 1,500 confirmed victories) but of having borne the brunt of the battle during the earlier stages of the war. It is continuing its good work now.

It was the Hurricane which was sent to France, where it had to operate from all sorts of aerodromes, spend most of its time in the open, and where it had to be maintained in the field with few facilities available. A less sturdy machine would have spent so much time on the ground that its effectiveness would have been seriously reduced.

Nor were the activities abroad of the Hurricane confined to France and Belgium. It saw service, if only for a brief period, as far north as Norway, and recently its sphere has been extended to even more distant theatres of operation. Throughout, its record has been one of complete satisfaction, and we have thought that many of our readers would be interested in the detailed account of its birth and evolution which we publish this week. The Hurricane has proved itself one of the world's greatest fighters.

Higher and Higher

THE fact that recently some of our fighters have, rather unexpectedly, encountered German aeroplanes at 37,000 ft. or more reminds us that, quite early in the war, *Flight* called attention to the fact that it would be well not to overlook the possibility that, sooner or later, Germany might make military use of the vast amount of altitude research work she carried out during the years preceding the war. It is a characteristic of the German mind that it thinks at once of possible military applications of any new invention, and it is scarcely to be expected that she would fail to see the enormous advantages which would fall to her were she to be able to produce aircraft capable of flying at heights well above the ceiling of our types and, of course, far above the effective range of anti-aircraft guns.

There is no evidence as yet that new German types, with two-stage or possibly multi-stage superchargers, are in service, but it behoves us to bear in mind the possibility that they may be on the way, and to see to it that we are not caught napping.

Before the war a small number of high-altitude commercial aeroplanes were being built, but one must assume that work on them has been stopped. It would be a mistake if all work on so-called stratosphere research had shared that fate, and we hope this is far from being the case.

Encouragement

AIR MARSHAL Sir Philip Joubert de la Ferté is a broadcaster whom everybody likes to hear. The pity is that, with the shortening evenings and the earlier arrivals of the nightly raiders, many people have taken shelter before the 9 p.m. news is broadcast. The B.B.C. is reported to be considering that fact, and to be contemplating a reform which would give the majority of listeners a chance of hearing the most important features after they have got home from business and before they go to ground. Such a reform would be welcome to many.

Sir Philip never indulges in wishful thinking. When he holds out grounds for hope, they may be accepted as valid. What the majority of people in this country, in Allied countries, and in the United States, particularly want to hear just now is the prospect of defeating the German night bombers. Everyone knows that the Germans will not win the war by knocking down buildings, even much-prized buildings like palaces and cathedrals, and killing civilians in London, the Midlands and Liverpool, while the damage to military targets through night bombing is not expected by the Germans themselves to lead to victory. But all the civilised world wants to see an end of this senseless destruction and slaughter.

It was therefore very good to hear the Air Marshal talk on the lines of entrusting the defence of cities by night to special fighter aircraft, instead of leaving the matter almost entirely to the A.A. guns. Those guns have done very useful work, but no student of air defence has ever expected fire from the ground to bring down any large number of raiders. That is the proper function of fighter aeroplanes. The Defiant, Sir Philip told us, was originally designed to be a night fighter, and it is to be restored to that rôle, with certain developments which are expected to be very effective. There is much comfort for harassed Britons in that prospect.

Sir Philip also laid stress on the increase in our bombing effort. In one night recently we were able to strike at Berlin, the Ruhr, the invasion ports, and several cities of Northern Italy. That is a wide programme, and the significant thing about it is that all the attacks were made in force—not by single machines or small formations. It is evident that the numbers of the Bomber Command have been swelled, but the great increase in the strength of the R.A.F. is yet to come.

Beaufort Torpedo-Carrier

TWO years ago representatives of *Flight* visited a station of the R.A.F. where two squadrons practised the art of dropping torpedoes from Vildebeest aeroplanes. Since the outbreak of war the public has heard nothing of torpedo attacks by the R.A.F., though the Swordfish and Albacores of the Fleet Air Arm have several times used this naval weapon with great effect—notably in damaging the French warship *Strasbourg* as she escaped from Oran.

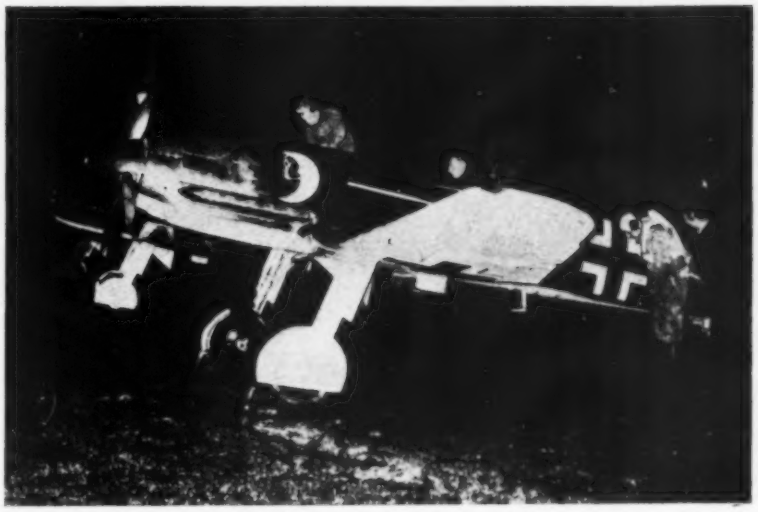
On Wednesday, October 23, there occurred the first recorded use by the R.A.F. of a torpedo attack, when Bristol Beauforts of the Coastal Command got home with their "mouldies" on two German supply ships which were moving in convoy off the Frisian coast. One of the ships, of 4,000 tons, was left sinking by the stern, while the other, a 2,000-ton vessel, was sinking so fast that her decks were awash as the Beauforts flew away.

Air-borne torpedoes, by the nature of things, cannot be so large as those discharged from the surface vessels of the Navy. The *Strasbourg* was not sunk by the blow delivered by the Swordfish, and is presumably being repaired at Toulon; but cargo vessels, which are not armoured, cannot hope to survive the impact of a torpedo launched from an aeroplane. Now that a modern type of machine, such as the Beaufort, is being used from shore bases for this form of warfare we may hope to hear of more successes at the expense of German ships.

HURRICANES IN ECHELON. An illustrated account of the birth and growth of this great fighter is published on pp. 369-373. During the first year of war more than 1,500 enemy aircraft were brought down by Hurricanes.

WAR in the AIR

Capt. Balfour's Confidence : Fog to the Rescue : Hard Blows at Germany : North Italy Raided Again



NIGHT FLYING NIGHTMARE : The Me 109 is known to be unpleasant to fly at speed during the daytime. At night more attention must be paid to the flying than the fighting.

CAPT. HAROLD BALFOUR, M.P., Under-Secretary of State for Air, made a speech at the Overseas Club on October 23, in which he gave his reasons for confidence in a British victory. In the past two months we had achieved what he believed was one of the greatest victories of the war, in taking such heavy toll of the enemy's mass formations of raiders that he had dropped this form of tactics in favour of the indiscriminate bombing of the civilian population. Another reason for his confidence lay in comparing the difference in the ways we and Germany were fighting the war. At the present time London was going through "ordeal by battle." Much material damage was being done to buildings and property, but Germany could not win the war by this means. Whereas our offensive raids into Germany aimed at hitting the enemy in their vital military, naval and industrial spots, so as to cripple their war effort, the German aim was to break the *moral* of our civil population. Just so long as they neglected military objectives to concentrate on these methods, then just so long would they be battering uselessly against the unbreakable spirit of our people, while our own striking force was engaged on real tasks which would bring us toward victory.

Capt. Balfour then went on to talk about propaganda, stressing that it must be honest. It was the enemy, afraid to tell the facts to their own people, endeavouring to create a false atmosphere in neutral countries, who had to use the weapon of propaganda for a crooked and deceitful part. Truth would out—and some day this deception would be uncloaked for the world—even the Germans themselves—to see.

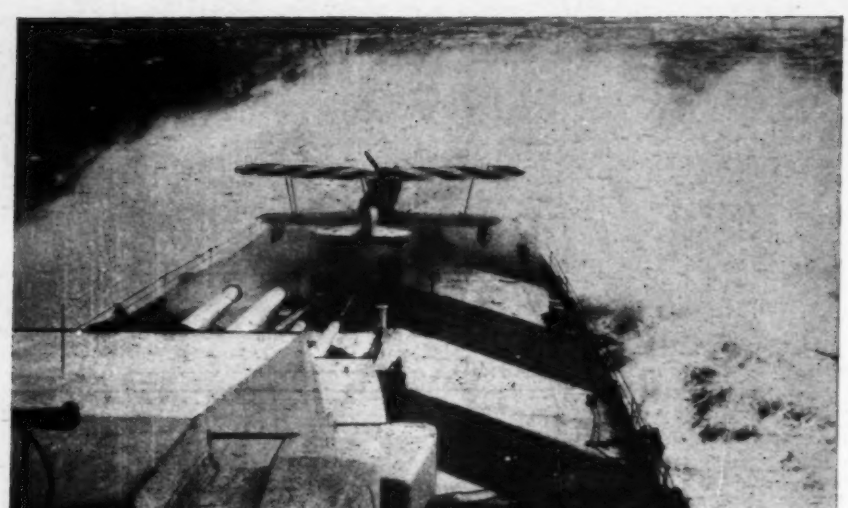
Unmasking German Lies

THE deception has already been uncloaked on certain occasions. Usually the British Government refrains from publishing details, for example, of the German machines which it claims have been shot down, because the enemy is anxious to learn all such details. Some three weeks ago, however, the Air Ministry departed for once from its rule. The Germans had stated that on October 8 only three of their aircraft had not returned from raids on Britain, whereas actually eight machines had been destroyed. So the Air Ministry published the details. Two Heinkels were shot down in the sea without survivors. Another Heinkel was burnt out at Stansted Park, near Chichester, and all the crew were killed, but the name of one was found to be Feldwebel Ernst Ens. A Ju 88 marked with a black eagle in a red circle was brought down at Bromborough Docks, Wirral, with one of the crew dead, two injured and one uninjured. Their names were Lt. Hubert Schlegel, Unteroffizier Helmut With, Sonderführer Horat Lehmann, and Oberleutnant Helmut Bruckmann. Another Ju 88 was blown up at Toovies Farm, Worth, Sussex, and only one disc was found with a number on it. A Dornier came down in the sea, five miles S.E. of Fraserburgh, and its crew of three were picked up unhurt. They were Oberleutnant Egon von Eickstedt, Oberfeldwebel Hubert Freund, and Hauptman Konrad Hardt. An Me 109, with the figure 2 in black and a red cat painted on it, fell at Hazeleigh, near Chelmsford. The name of the wounded pilot was Feldwebel Paul Boche. Another Me 109 was wrecked at Folkestone. The pilot, Oberleutnant Werner Voight, was unwounded. The Air Ministry explained that this frankness cannot be a regular custom, but even this one case must confirm the belief in the honesty of British claims which is already widely entertained by neutral peoples.

The weather is notoriously a favourite topic of conversation among people whose good or bad fortune it is to live in the British Isles, but of late the weather has been a more vital subject than usual among Londoners. In the summer, of course, one is accustomed to hearing gardeners complaining that the country wants rain, but in autumn they are not so prone to grouse about a little sunshine. Nobody has ever been heard before to say a word in praise of the London fog. But of late London has come to recognise in rain and fog very good friends which have curtailed the terror that flieth by night. On several nights last week the weather reduced the attentions of the German bombers over the London area, and even by day the raiding was not on a heavy scale. Most of the visitors were fighters or fighter-bombers, and they mostly flew very high. One day some Spitfires were flying at 37,500 when they encountered Messerschmitts above them. This tallies with the theory which has been advanced in these columns that the enemy is now taking care not to risk heavy losses of his heavy bombers, which may be needed for a campaign elsewhere. Fighter-bombers can keep up the irritation and do a certain amount of damage, while they are not likely to be shot down in heaps, and if some are destroyed the loss to the *Luftwaffe* is not very serious.

But, while London has enjoyed several days and nights of comparative quiet, certain towns in the Midlands, and also Liverpool and the whole of Merseyside, have had a worse time. In fact, on Monday, October 21, Liverpool endured its 200th raid.

To run briefly through the diary of the week, the day raiding on *Sunday, October* 20, was not heavy anywhere, and was mostly due to fighters and fighter-bombers, which were flying very high. Seven German machines were shot down that day, while the R.A.F. lost three fighter



WAR IN THE AIR (CONTINUED)

SHIPPING IT GREEN: A Meridionali 43 reconnaissance aircraft on the catapult of an Italian cruiser. The position of the catapult in the bows of the ship seems to give the aircraft a hard time compared with the sheltered position of the double catapults abaft the beam on our cruisers.

machines, but all the pilots escaped. By night the chief enemy attack was directed against two towns in the Midlands and Liverpool. London had an easier time. Four German raiders were shot down during the night. On *Monday, October* 21, some single machines penetrated to London, the Midlands, and the North-West during the day, and a factory in Lancashire was bombed. By night the chief damage occurred in a Midlands town. There was a ground mist over London, and though the invasion was active at first, it soon slackened off. A maternity home, a hospital, and a magistrates' court were bombed in the capital, but there were no casualties at any of them, and next day the magistrates sat in the court in spite of its damaged condition. During the day one bomber was shot down at New Milton, Hampshire, and all four members of the crew were killed. A Dornier 17 crashed between Harwich and Ipswich, and its crew escaped by parachute and succeeded in hiding themselves. The rear gun cockpit of a Dornier was picked up near Barnet on the Great North Road. Another Dornier crashed in Wiltshire and its crew of four surrendered at farms and houses near by. One of them knocked at a lonely bungalow inhabited only by a woman. She directed him to the nearest village, but he could not find his way in the dark, and apparently wandered about for the rest of the night, until at dawn he was able to surrender to some roadmenders. Presumably he had to observe British black-out regulations and not show his torch in the dark. If he had done so he might have attracted a bomb from one of his friends.

Famous Buildings Damaged

AGAIN on *Tuesday, October* 22, there was little bombing inland, though a fairly large force of Germans was met by our fighters coming in over Dungeness. A sharp combat ensued, in which it was estimated that some 100 machines were engaged, and the raid was kept out. Only three German machines, however, were shot down that day. We lost six fighters, but two of the pilots escaped, whereas the crews of the German machines were lost to the Fatherland. There was a dense mist in the Channel that night, which probably prevented many raiders from starting, for it may well have covered their aerodromes as well. London was not much worried that night, but another famous shopping store was hit, and some of the staff in the shelter were killed or wounded. The attack on Midlands towns was somewhat heavier. The sirens only sounded twice in London on *Wednesday, October* 23, and the German efforts gave no suggestion of any attempt to drive John Bull to his knees. Such attacks as there were came from single aircraft, and though they killed some people in London and in towns in Kent and the East Midlands, the sum total of damage was inconsiderable. The night raiding started earlier than before, but after some energetic firing by the A.A. guns the activity died away. Through some mistake, the "all clear" was sounded while the noise of a pair of engines could be heard overhead, and some rounds from the A.A. promptly followed. The signal had to be cancelled by another warning almost at once, but the sky was at no time really full of raiders.

Among the buildings damaged in recent raids are Holland House, the American Embassy, and the hall of the Middle Temple. It was in the latter that Shakespeare's *Twelfth Night* was first performed.

The Air Ministry News Service has issued the following: Members of the public who are on the scene when a British pilot is trapped in his crashed aircraft should observe the following rules in attempting a rescue: Approach the aircraft from the rear—away from the airscrew. If the aircraft is upside down and one wing is higher than the other, approach on that side from the rear.

Fire extinguishers, if fitted, are automatic and cannot be operated from outside the aircraft.

To open the cockpit hood look for the release catch at the front end and draw the hood backwards. If the hood cannot be opened break the transparent material with anything hard.

To remove the pilot look on his chest for the locking-pin which attaches his harness to the aircraft. Pull the cord fastened to the locking-pin, then lift the harness attachments from the central pillar and remove the pilot with his parachute attached to him.

Experienced aid should be obtained if opportunity and time allow. It is important that a wounded man should be disturbed as little as possible, and every care must be taken to avoid harmful movement. In the event of fire or danger of it speed of removal is the primary consideration.

After the pilot has been removed his parachute may be released by means of a round aluminium disc attached to the front of the pilot. Turn the disc as far as possible in the direction of an arrow marked "Turn to unlock" and then press in to the pilot. Splints, stretchers, or lifting tackle may help in the removal of casualties if there are sufficient openings in the aircraft.

Bombing for Victory

BAD flying conditions have set in earlier this year over the Continent than over the British Isles. R.A.F. night bombers have further to go than German night raiders, and lately they have had to put up with far worse weather conditions. The following is the account of the work done on the night of *Wednesday, October* 16, issued by the Air Ministry News Service. It can be taken as typical of what our night bombers are doing and enduring. The attacks were pressed home in the face of strong opposition from heavy and light guns.

At the time of the raid on Kiel drifting cloud made observation of the results extremely difficult, but in the course of the bombardment, which lasted for over two hours, many high-explosive and incendiary bombs were seen to

WAR IN THE AIR (CONTINUED)

burst among buildings in the Deutsche Werke and the Germania yards. A salvo of high-explosives is believed to have scored a direct hit on one of the main jetties.

The first raiders to take off from their base in England reached the target area soon after 9 o'clock, and, according to one pilot, they were luckier than some of the others who followed, for on their arrival they found "a great horse-shoe-shaped gap five miles across in the cloud layer over Kiel." Another pilot, who was among the first to bomb the dockyards, said:—

"We came round a little to the south of Kiel and then ran up from south-east to north-west, coming out over the top of what appeared to be a warship lying in one of the floating docks. The dock itself was perfectly outlined by the moon. We at once doubled back and ran up again from the same direction. This time we dropped a stick of bombs, and, from all accounts, it must have straddled the ship. Before we had time to see the full results, however, the edge of the cloud just began to close in over the area. We circled round four or five times, but could not see very much, so set course for home." A third pilot, bombing soon afterwards, said that he thought that two of his bombs must have hit the same ship or the jetty near, but again drifting cloud prevented accurate observation. In an attack on a different part of the dockyards bombs were reported to have fallen a "ship's length" astern of another warship. Two fires at once broke out.

Later a bomber from another section of the raiding force spent a full half-hour over the docks before bombing. "When we first got there," the pilot said, "the cloud had not quite reached the basins and we saw in one of them a German warship. We ran over the basin, but the moon was behind us, and we were right over the top of the ship before we saw it. All the time the clouds were getting worse, but we made another run, and through a gap in the cloud we caught a glimpse of the ship and let go our bombs." Fifty-five miles south of Kiel, other raiders were hammering the docks at Hamburg, but here again clouds hid the results of the bombing.

The Leuna Oil Plant

AT the same time other targets in Germany were attacked. At Leuna the large synthetic oil plant which has been damaged in previous raids was again subjected to a prolonged bombardment. When the first bombs dropped a large fire was started, and this guided other aircraft to drop heavy-calibre bombs at regular intervals on the works. Many other fires were seen to break out, followed by many explosions.

On the night of *Sunday, October* 20, Berlin and North Italy were both attacked by the R.A.F. A thick ground haze over the German capital made targets difficult to locate when the first British bombers arrived, but the crews persisted and ultimately placed their bombs with accuracy. A large warship is believed to have been hit at Wilhelmshaven. Industrial targets at Turin, Milan, and Aosta were likewise damaged, and a number of other enemy centres were visited. A number of daylight raids on the invasion ports were carried out on *Monday, October* 21, and two vessels in a German convoy off Dunkerque were damaged by bombs. That night enemy warships in the Blohm and Voss yards at Hamburg were one of the chief targets, while the Ruhr received a visit at 7.30 p.m. Another enemy cargo vessel was bombed on the afternoon of *Tuesday, October* 22.

The German seaplane base at Tromsoe, on the north coast of Norway, well within the Arctic Circle, has been successfully attacked by naval Swordfish and Skua aircraft. Many hits on the target were seen and fires were started. A supply ship was attacked and almost certainly damaged by near misses. One Skua made a forced landing in neutral territory, but the crew are known to be safe.

The Germans have also been trying to attack British shipping. One day recently a Heinkel 115 float-plane dived out of dense cloud over the North Sea and dropped two bombs—towards a convoy. Both bombs missed. Believing that he had the sky to himself, the German pilot made ready for a second attack, but a fighter of the Coastal Command, which was escorting the convoy, swooped through the cloud bank and, with two machine-gun bursts, set the enemy on fire. The tanks of the Heinkel blew up—douching the nose of the Blenheim with oil. Near sea level the float-plane broke into pieces. Because the windows of the British fighter were so thickly coated with the enemy's oil, the pilot and navigator had a difficult journey back to base. It was dark when they arrived, but they made a safe landing.

Results of R.A.F. Raids

FROM reliable neutral sources further reports have been received which make plain the effectiveness of the R.A.F. offensive against military objectives in Germany.

In Berlin, according to one neutral observer, the damage is extensive. Several factories employed on the production of vital war material are said to have been partially wrecked; the General Post Office has been almost gutted, and some of the city's main gas works have been badly damaged. The fire that was started by R.A.F. bombers during an attack on the Lehrter railway station and goods yards apparently burned for many hours, and smoke from it covered a large part of the capital. Traffic was further interrupted by raids on the railway sidings at the Potsdam and Anhalt stations. The damage done here, combined with that inflicted on other important lines of communication outside the city, seriously affected the German transport system. One traveller, setting out from Berlin for a town in the Rhineland, had to spend three days, instead of the customary twelve hours, on the journey. Much changing was necessary, and at times the passengers had to walk some distance from one train to the next. Other travellers report that they have had to change more than a dozen times on what was previously a straightforward trip, and even then there were long delays outside some of the stations.

Transport on the German waterways, too, has been dislocated. Traffic, for instance, on the Mittelland Canal was interrupted for five days after the destruction of two sluice gates, and on the Dortmund-Ems Canal the east wall immediately north of the old aqueduct has been broken,

COURAGE WITHOUT GRIT: An armourer of the R.A.F. in the Western desert fusing a 500lb. bomb.

AIR LOSSES DURING WEEK ENDING OCTOBER 26

	GERMAN Aircraft	BRITISH Fighter Aircraft	Pilots
Oct. 20 ...	9*	3	—
" 21 ...	4	—	—
" 22 ...	3	6	4
" 23 ...	—	—	—
" 24 ...	3	—	—
" 25 ...	16	10	3
" 26 ...	6	2	2
	41	21	9

* (One was shot down by a Hudson)
British Bomber losses on enemy territory :—Oct. 20, 1 ; Oct. 21, 1 ; Oct. 23 1 ; Oct. 24 1 ; Oct. 25 1 ; Oct. 26, 2. Total, 7.

and there are two fresh bomb craters on the east embankment. Other evidence of the success that has attended the R.A.F. attacks on this target is to be found in the damage done to the harbour and the loading installations and to the barges moored near. Confirmation of the damage done to the petrol and synthetic oil plants at Politz, near Stettin, has also been received, together with news about a tanker which had to postpone its visit to Stettin as the petrol load it was to have shipped was not available. From the same source it is understood that on the night of October 2 a large ship, fully loaded with grain, received a direct hit, caught fire, and was still burning two days later.

At Hamburg, during another raid, five ships are said to have been sunk in the harbour. At the time this news was gathered it was further seen that only seven out of seventy-five cranes on the quay were working. Most of the unloading was done slowly and laboriously by the ships' derricks. Great industrial plants over a wide area of Germany have been severely punished as well. The large aluminium works at Bitterfeld, it is stated, were closed for some weeks after a heavy raid and, according to another neutral report, in the Rhineland the Westphalia electricity works have been so badly damaged that it will be some time before they come into full operation again.

There is evidence, too, of the value of the R.A.F.'s determined attacks on the "invasion" ports. One report states that on September 16 many German troops were embarked, but were later taken off the ships. The invasion plans were not adopted because of the sustained offensive by the Royal Air Force, whose extraordinary accuracy in bombing has incidentally been much admired by the Dutch. For instance, during a recent attack on a factory in Holland a British bomber was seen circling over its target for half an hour before making an attack. Then a single bomb was dropped, scoring a bull's-eye and wrecking the drafting department and main machine shops.

WAR IN THE AIR (CONTINUED)

The War With Italy

AN interesting sequel to the sinking of three Italian destroyers by H.M.S. *Ajax* in the Mediterranean has been disclosed. An Italian hospital ship on its way to Italy was led by a Sunderland flying boat of the R.A.F. to the area where there was a mass of wreckage, boats and rafts.

The pilot of the Sunderland, a Flight-Lieutenant, said: "We were on patrol at 8 o'clock in the morning when we saw smoke on the horizon on our starboard bow. I altered course to investigate and saw what at first appeared to be a merchant ship. I went round, and then gradually closed on the vessel, which we recognised as a hospital ship. We came in close, and saw that she was the *Aquileja*, and then went off. Two or three miles away we saw ships, floats and other objects in the water. We signalled to the hospital ship: 'Ship's floats below us,' and I dived two or three times to attract attention. A few minutes later I saw the hospital ship alter course, and later lower a white dinghy which set out in the direction of the floats. We circled round looking for survivors. We could not definitely see any, though there were many objects in oil which might have been men. Later we resumed our patrol."

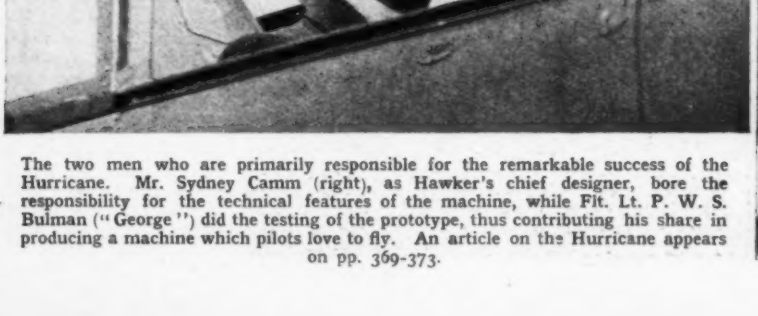
Outraging Muslim Sentiment

WHEN Mussolini visited Libya some years ago he flamboyantly proclaimed himself the "Protector of Islam." His reputation as such was considerably damaged by his invasion of Albania. Now Italian "protection" has been further discredited. The great Muslim fast of Ramadan corresponds somewhat to the Christian Lent, but is more strictly observed. Italian propagandists had promised that no Muslim territories should be attacked during the month of fasting. But on *Saturday, October* 19, Italian bombers from the Dodecanese Islands attacked the properties of the Standard Oil Co. on the Bahrein Islands in the Persian Gulf, although the period of Ramadan was not over. It was a flight of 2,800 miles. Bombs were dropped on Dhahran, which is in the neutral State of Saudi Arabia, and also when returning from the Gulf to Eritrea (where the flight ended); the Italian machines must have flown over the Héjaz country in which lie the Muslim holy cities of Mecca and Medina. This would give great offence to Mussulmans.

An S.79 was intercepted over the Red Sea by R.A.F. aircraft and chased for thirty miles on *Monday, October* 21. The enemy bomber was last seen losing height rapidly and emitting thick black smoke from its fuselage.

An enemy destroyer in the Red Sea was attacked by R.A.F. bombers, and a hit was registered on its stern.

THE HAWKER HURRICANE FROM A TO Z



The two men who are primarily responsible for the remarkable success of the Hurricane. Mr. Sydney Camm (right), as Hawker's chief designer, bore the responsibility for the technical features of the machine, while Flt. Lt. P. W. S. Bulman ("George") did the testing of the prototype, thus contributing his share in producing a machine which pilots love to fly. An article on the Hurricane appears on pp. 369-373.

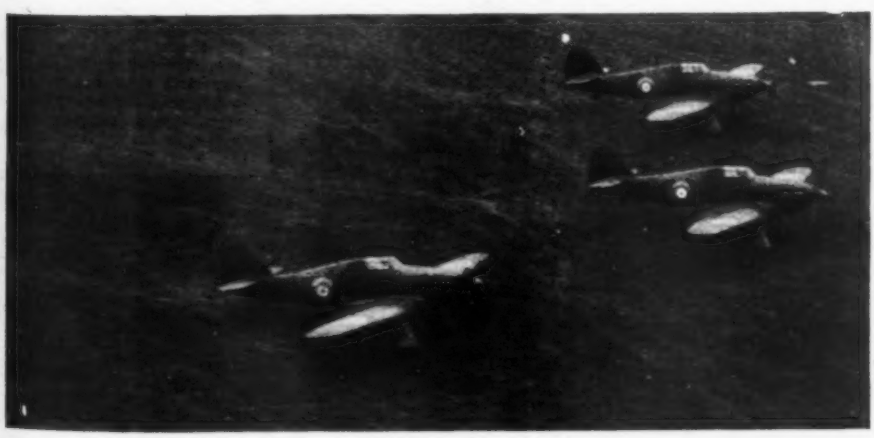
The Birth and Growth of a Great Fighter Described

By THE EDITOR

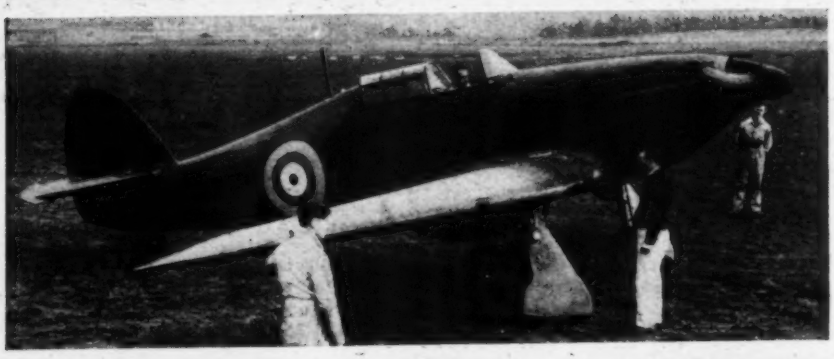
"IN spite of the dazzling performance, we permit ourselves not to fall into admiration. The machine is too heavy to be manœuvrable, too powerful to have the range necessary for making contact with the enemy. As we see it, the new Hawker monoplane is an experimental speed aeroplane and not a truly military aircraft, the more so as the practical conditions of chasing at speeds approaching 'limiting performance' are still unknown."

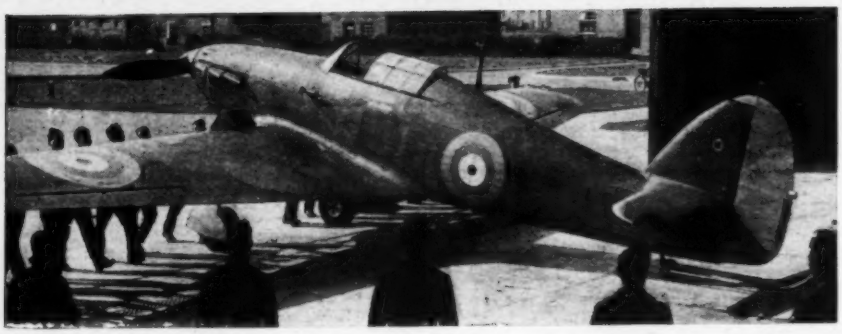
It would be difficult to imagine a more completely wrong appreciation of the Hawker Hurricane than the words quoted above. Yet they were published in a French aviation journal in the autumn of 1935, when the first machine had just begun its test flights. In fairness to the journal concerned it should be pointed out that at that time the French aircraft industry was itself hard at work evolving prototype fighters, and the general tendency in French aviation circles was to think of fighters in terms of small size and relatively low power. It was thought that speed and manœuvrability were of greater importance than gun power. Four years later that same Hurricane came to the assistance of France's air force, and it proved better by far than any of the French and American fighter types with which the *Armee de l'Air* was trying to stem the Nazi tide.

Even at home at the present time it is very doubtful if the merits of the Hurricane design are truly appreciated. Everyone knows that it is a good fighter, but how many realise that the design is some seven years old? And how many can assess at their true value the many decisions which had to be made at the time the design was being got out? Let it be remembered that in those days we had in service in the Royal Air Force nothing but biplane fighters; that data for monoplane design were very meagre; that we had been using strip steel and steel tube almost exclusively in our



ON THEIR WAY: Three Hurricanes taking off in formation from an R.A.F. aerodrome. The rate of climb at sea level is 2,400 ft./min.





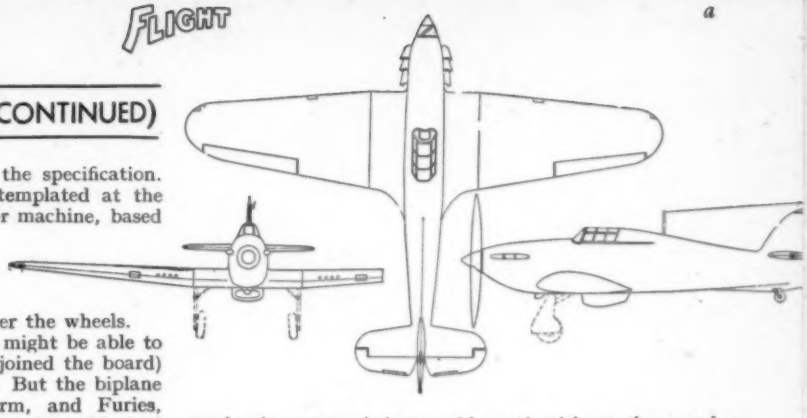
THE HURRICANE (CONTINUED)

structures; that the retractable undercarriage was still an almost unknown quantity in this country because we had been using biplanes exclusively, a type which does not lend itself readily to the fitting of retractable wheels.

Quite a few people know that the Hurricane complied with Air Ministry specification F.36/34; in other words, that the specification for interceptor fighters, based upon the use of the then new Rolls-Royce Merlin, dates back to 1934. Actually, there is more in the story than that. The writer of these notes remembers having the privilege of being shown by Mr. Sydney Camm, Hawker's chief designer, an outline drawing of a monoplane single-seater many months before the F.36/34 specification was issued. That sketch design had all the essential characteristics of the Hurricane, but the Air Ministry had not at the time decided upon the armament to be carried, nor upon many other features

FIVE YEARS' PROGRESS: The evolution of the Hurricane since its first flight in Nov. 1935 to the present day. The original model had struts to the tailplane and a retractable tail wheel. After the first flight the engine cowling was bent by the battering of the slipstream, and the first real dive and zoom across the aerodrome sucked the panels out of the cockpit cover. In the production model (2nd from the top) the tail wheel is no longer retractable, the cockpit cover redesigned and streamline exhausts fitted. At the stage when the third photograph was taken the wooden airscrew was still in use, but ejector exhausts had been fitted. Metal wings were beginning to come through the shops. The bottom picture shows it in its present day style with bullet proof windscreen, three bladed constant speed airscrew and anti-spin fin surface under the tail.

THE HAWKER HURRICANE (CONTINUED)



which were later to be incorporated in the specification. Eight-gun armament had not been contemplated at the time, and so the design was for a smaller machine, based upon the Rolls-Royce Goshawk steam-cooled engine. The loaded weight contemplated was just under 4,000 lb. The undercarriage did not retract, but was of the cantilever type with spats over the wheels.

Mr. Camm expressed the wish that he might be able to persuade the directors (he had not then joined the board) to sanction the building of the machine. But the biplane was the "bread-and-butter" of the firm, and Furies, Demons, Harts, etc., were doing excellent work, and looked like continuing to do so for many years to come. The interference with production which was the inevitable result of putting through an experimental design could not be faced lightly.

When the specification ultimately was issued to manufacturers, Mr. Camm already had the main features settled in his own mind, and many of them were "on paper." He realised—and told the writer so—that stressed-skin construction was the coming thing, but the firm was not equipped for it, and to make the production of the first machine as easy and rapid as possible he decided on a form of construction which was really the logical development of that which had been used in the Hart and all its successors and variations.

How wise was that decision was to be proved during the following years. Not only was the Hurricane in the air many months before any other type ("George" Bulman made the first test flight in the early autumn of 1935), but production proceeded smoothly and without those unfortunate breaks which would have been inevitable had the shops been obliged to change over to sheet metal.

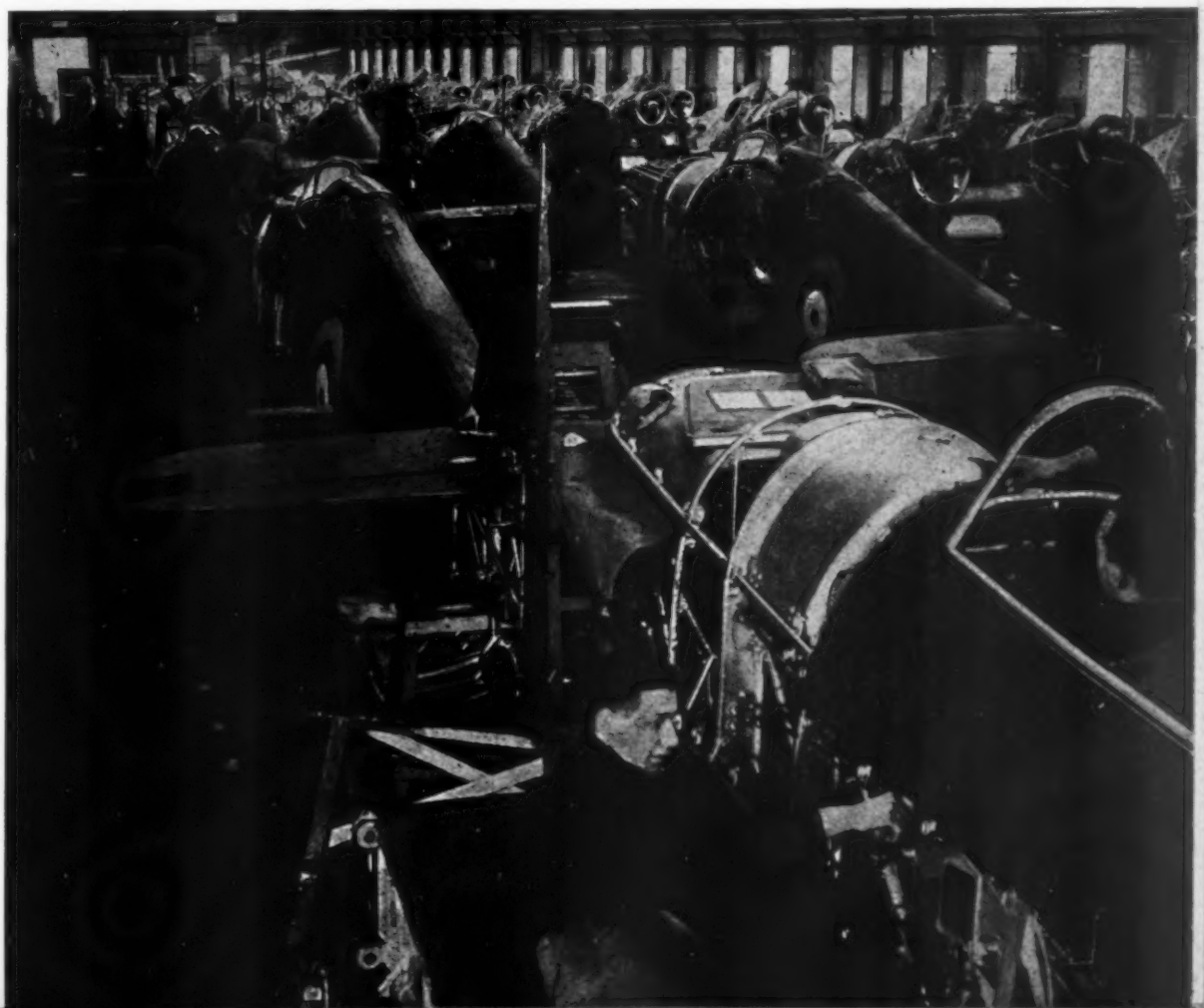
Many wise heads were shaken when fabric covering was chosen. It would never "stay put" at speeds far above 300 m.p.h. And if it did not actually tear off, there would be trouble with keeping it taut in service conditions. And sagging wing fabric might upset the airflow and cause all sorts of unpleasant consequences, apart from spoiling performance. Subsequent events proved that these fears were unfounded, a method of attaching the fabric to the ribs being evolved which made the attachments as strong as the fabric itself.

From both the production and the service maintenance point of view there was much to be said for the fabric-covered girder structure. Installation of equipment was facilitated, as men could work all around the machine and reach all manner of awkward corners through openings between girder members. Should the fabric be torn, or become soggy, it was a simple matter to replace or patch it.

(Continued on page d.)

ON THE WAY: Hurricanes in various stages of erection.

"Flight" photograph



THE HAWKER HU

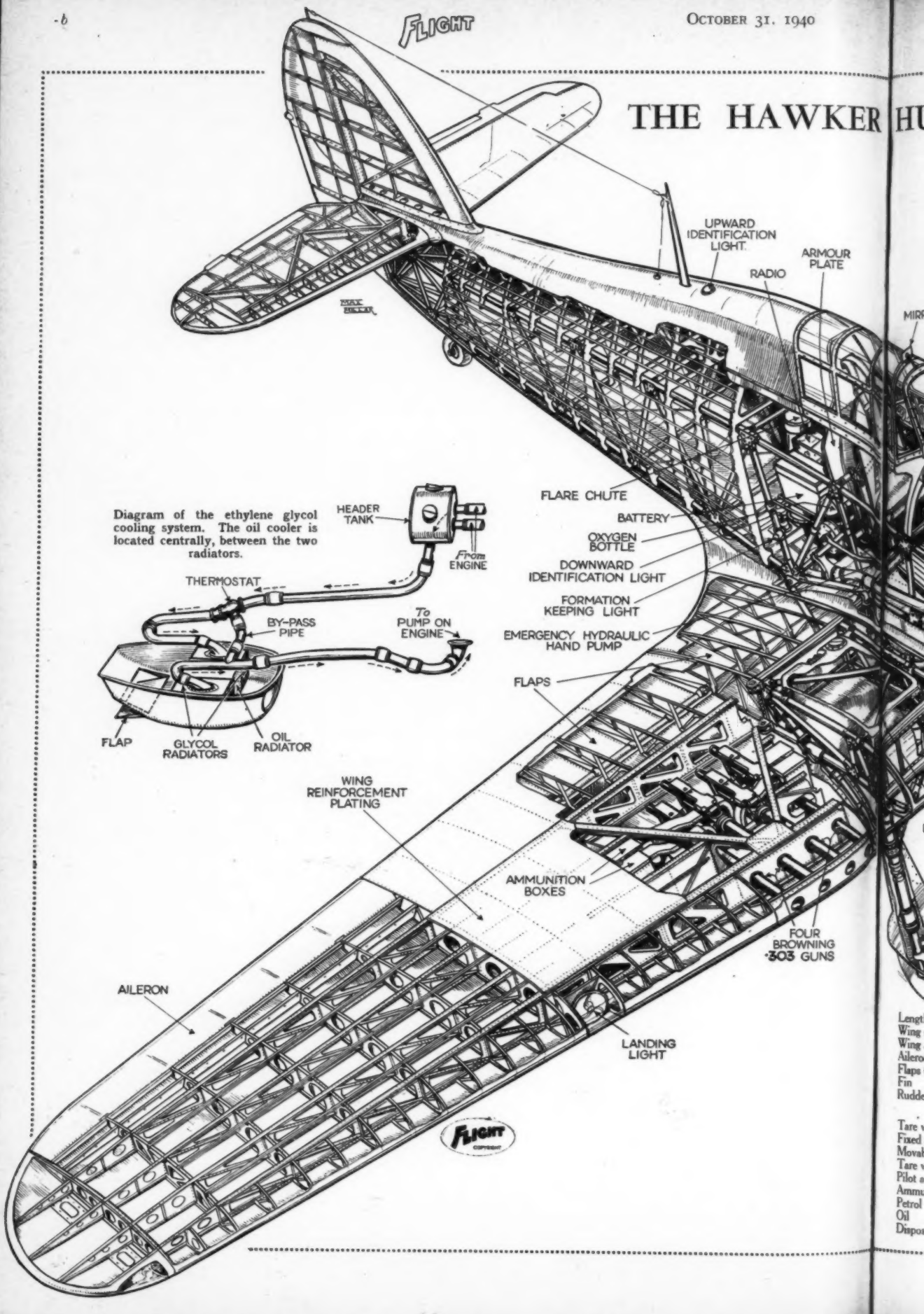
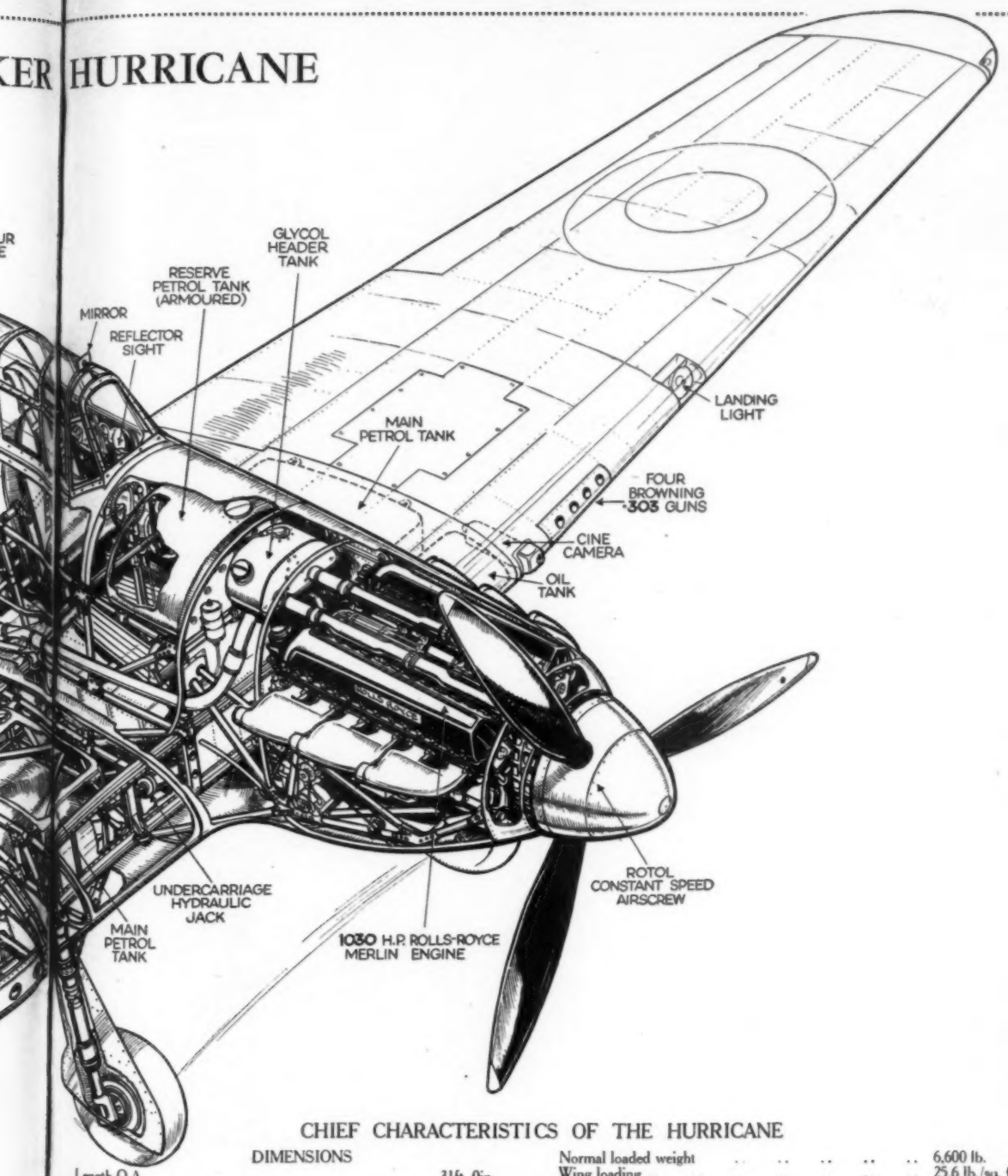


Diagram of the ethylene glycol cooling system. The oil cooler is located centrally, between the two radiators.

KER HURRICANE



CHIEF CHARACTERISTICS OF THE HURRICANE

DIMENSIONS

Length O.A.	31ft. 0in.
Wing span	40ft. 0in.
Wing area	257.5 sq. ft.
Ailerons (2)	19.6 sq. ft.
Flaps (2)	24.0 sq. ft.
Fin	8.8 sq. ft.
Rudder	13.1 sq. ft.

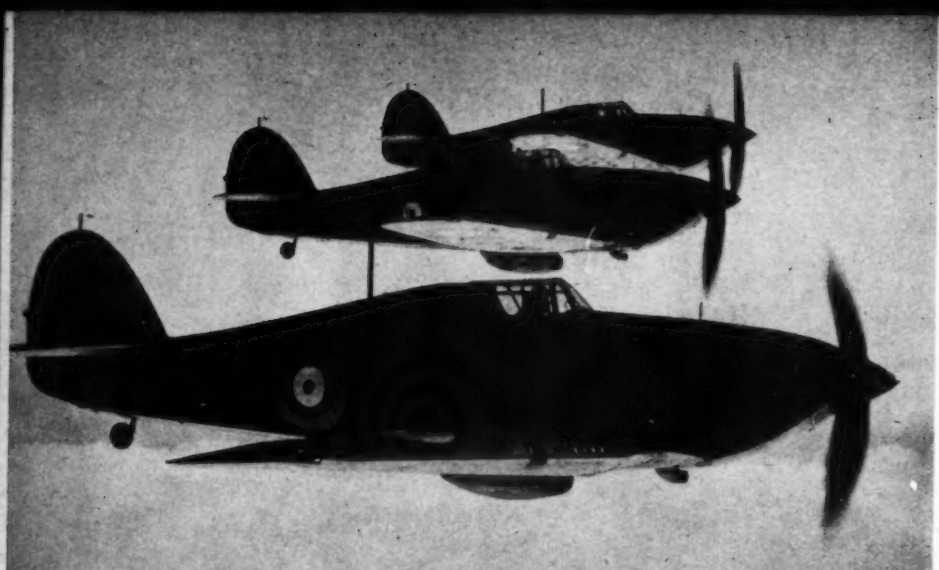
WEIGHTS AND LOADINGS

Tare weight (bare)	4,911 lb.
Fixed equipment	316 lb.
Movable equipment	357 lb.
Tare weight (equipped)	5,584 lb.
Pilot and parachute	200 lb.
Ammunition	159 lb.
Petrol	589 lb.
Oil	68 lb.
Disposable load	1,016 lb.
Normal loaded weight	6,600 lb.
Wing loading	25.6 lb./sq. ft.
Power loading	6.4 lb./h.p.

PERFORMANCE

Maximum speed :	335 m.p.h. at 18,500 ft.
	272 m.p.h. at ground level.
Range :	830 miles at 168 m.p.h. at 5,000ft.
	800 miles at 180 m.p.h. at 10,000ft.
	775 miles at 196 m.p.h. at 15,000ft.
	730 miles at 213 m.p.h. at 20,000ft.
	695 miles at 232 m.p.h. at 25,000ft
Climb :	5,000ft. in 2.1 mins.
	10,000ft. in 4.3 mins.
	15,000ft in 6.5 mins.
	20,000ft. in 9.3 mins.
	25,000ft. in 13.1 mins.
Service ceiling	35,000ft.

THE HAWKER HURRICANE (CONTINUED)



"Flight" photograph.

EARLY ECHELON: A flight of three Hurricanes from the first squadron to be equipped with eight-gun fighters.

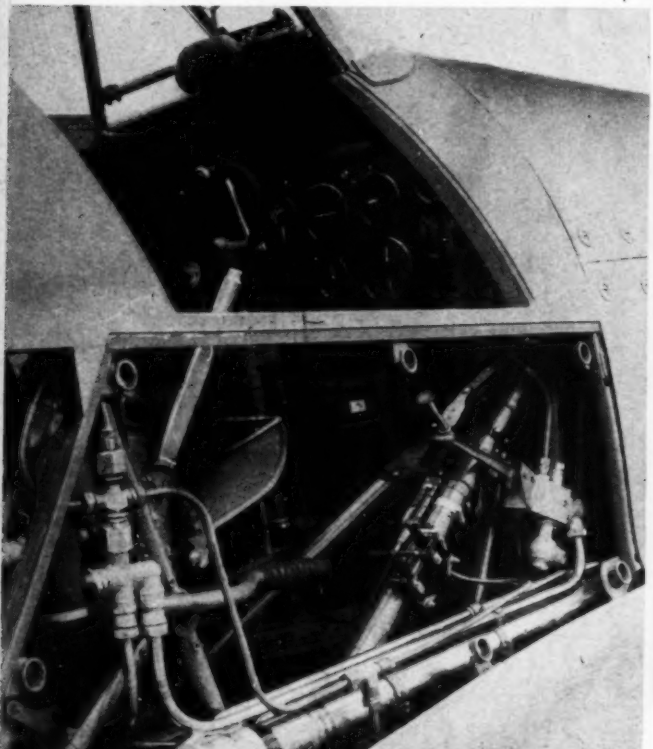
In actual fact, this was found to be the case on the Hurricanes which did such good work in France. They were not always very "professional" to look at, with their coloured patches, but they did their job in conditions which would have been well nigh hopeless for a more "delicate" machine.

The writer remembers very clearly upbraiding Mr. Camm for designing so large a machine. He also remembers Mr. Camm's reply: "Well, you see, the Air Ministry people always add all sorts of things afterwards as an afterthought, and, although we *could* have built a much smaller machine around the Merlin, there would have been no room for afterthoughts." Mr. Camm was speaking from experience. In the Hart he chose gauges of strip which were well in excess of those strictly necessary. But before the Hart and its variations had finished their careers the loads, and consequently the loaded weights, had gone up and up, and the extra strength proved very useful. So with the Hurricane he was not going to run any risks. The machine was large enough for a two-seater, but the space came in very handy during its subsequent evolution. For, of course, the prototype had not all the detail features of the Hurricane which we know to-day as the Mark I.

As originally designed, the Hurricane was fitted with the Rolls-Royce Merlin C of 1,025 h.p. The maximum speed was 325 m.p.h. at 16,500ft. The undercarriage fairings differed slightly from those fitted on the modern version, and the exhaust was of the stub pipe type. The tailplane was braced by a single strut on each side, as there was little practical experience of high-speed, low-wing mono-

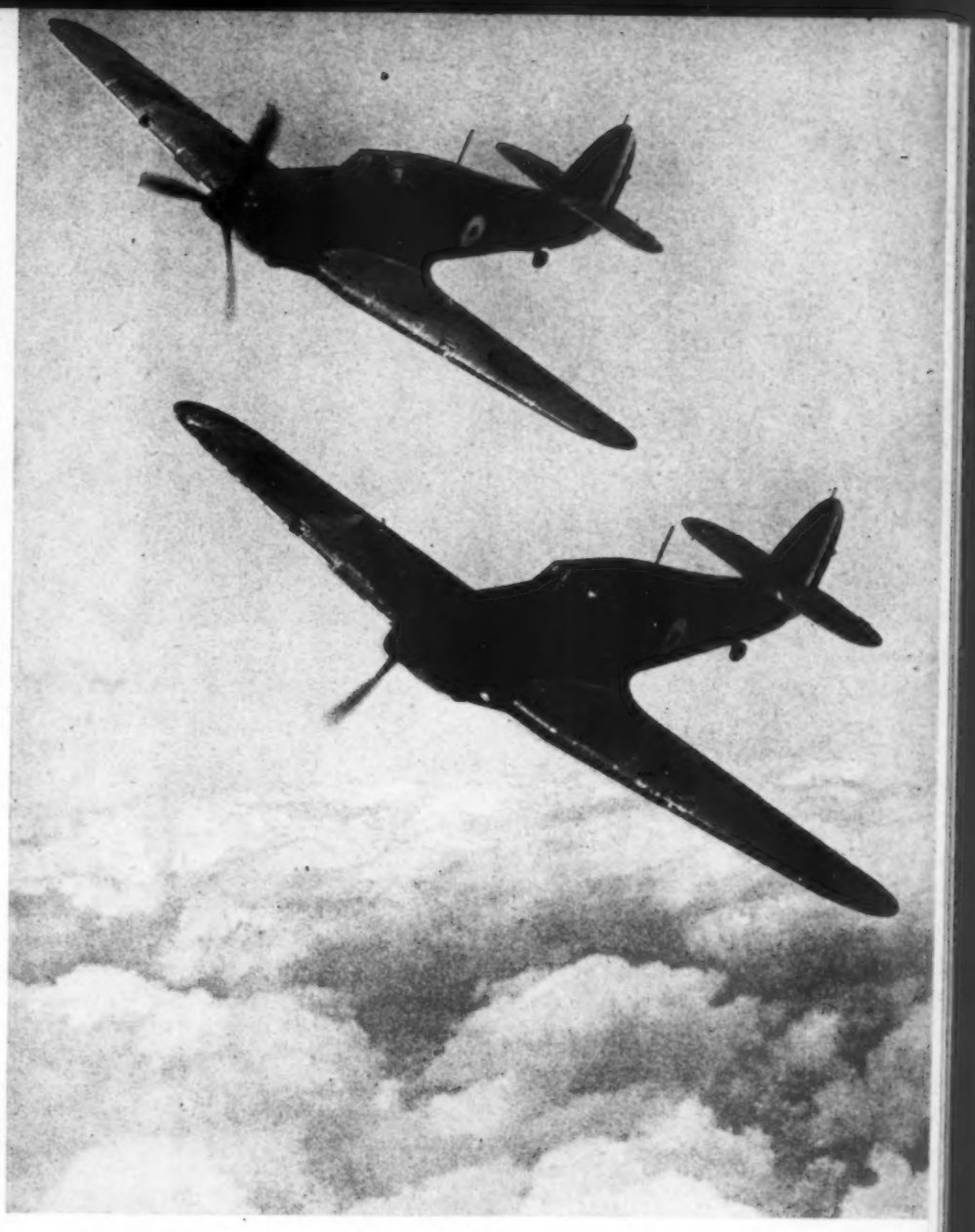
HURRICANE PILOT: Dressed for modern high flying the pilot has a fur lined Irvinsuit and seat type parachute. The face mask incorporates oxygen breathing apparatus and microphone. Closing the hand-hold on the right of the picture causes the step to retract.

OFFICE OF WORKS: In this picture of the pilot's cockpit can be seen the blind-flying panel with compass beneath; the gun trigger on the joy stick spade grip; the seat raising and lowering lever, and the emergency hand pump for operating flaps and undercarriage



"Flight" photographs

THE HAWKER HURRICANE (CONTINUED)



TIGHT FORMATION: The Hurricane is exceptionally manœuvrable and accurate in response to the controls. This picture was obtained above the clouds over France earlier this year.

planes, and it was expected that some trouble might arise with tail buffeting. This was not found to be the case, and in subsequent versions the tail is pure cantilever.

By the time the very extensive programme of experimental flying with the prototype had been completed, a later version of the Merlin, the Mark II, was available, and the first production Hurricanes, which came out in the autumn of 1937, were fitted with this engine. Slight changes were made in the engine mounting and cowling, and so-called streamline exhaust pipes were fitted. The first batch of machines went to No. lll squadron at Northolt, and as a result of the squadron's experience with them some minor modifications were made. These were by no means of a serious nature, but they helped still further to improve the performance and general handling.

As the speed of the Hurricane has gradually improved, it may be of interest to recall some of the modifications. One was the addition of a small fin under the stern. The original prototype had a retractable tailwheel, but when the fin was introduced a fixed tailwheel was substituted. The main purpose of the added fin area was to improve the anti-spin qualities, but it also served to fair the tailwheel support. A more important change, from the performance point of view, was the introduction of the ejector type of exhaust pipes. These added several miles per hour to the speed.

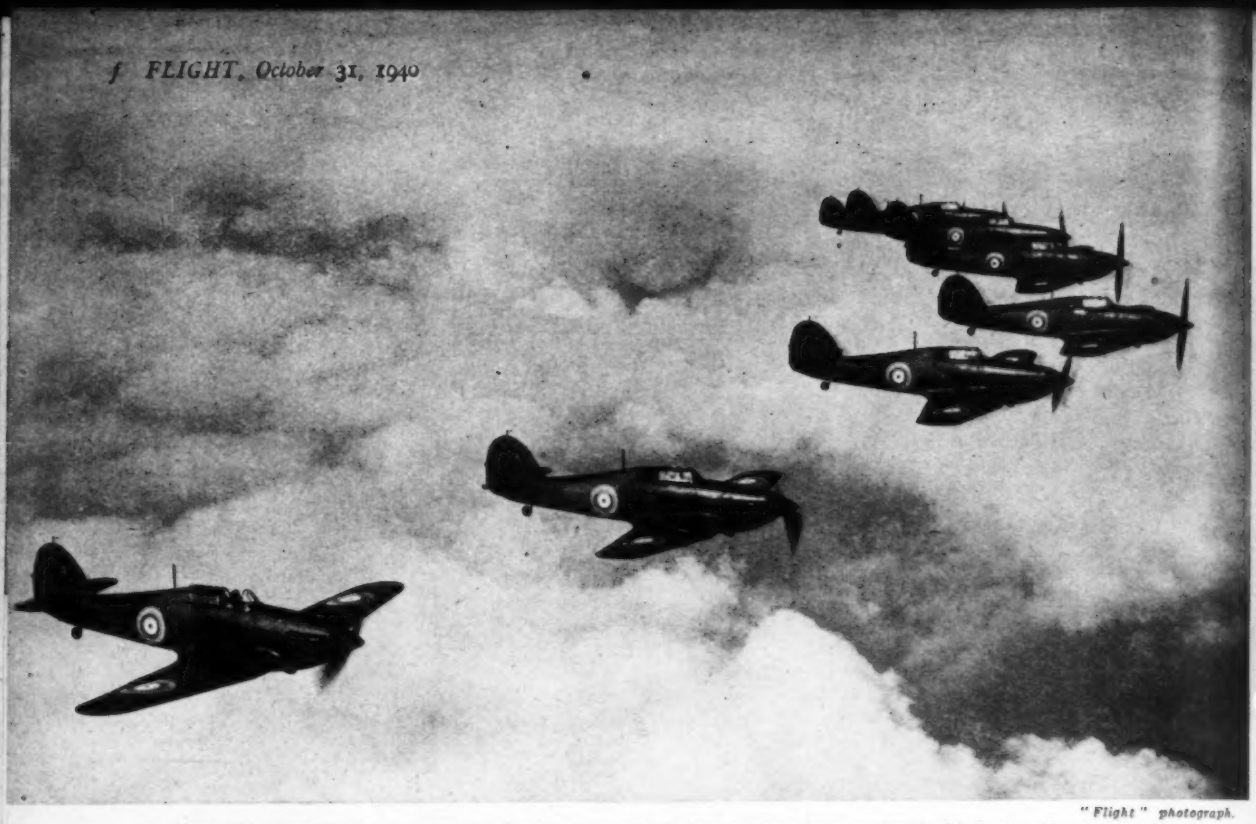
The prototype Hurricane was fitted with a two-bladed wooden airscrew, as it was felt that the power available for take-off was so ample that even with the airscrew blades stalled at the beginning of the take-off run there was plenty in hand, and the saving in weight was worth having. As time went on, however, and the demands for the last ounce of performance became insistent, variable-pitch airscrews were introduced. The first type to be fitted was the De Havilland two-position airscrew. Later developments saw the introduction of the De Havilland and Rotol constant-speed airscrews, and the latter are found on all the latest versions of the Mark I.

In spite of the good results given by the fabric-covered wings of the earlier Hurricanes, the Air Ministry deemed it wise to change to stressed-skin wings, or, at any rate, to have a number built so that they could be tested in actual service against the fabric-covered. The change was not a difficult one for the Hawker company to make, for in the meantime a two-seater had been designed and built to Air Ministry specification P.4/34, and this machine has outer wings identical in dimensions with those of the Hurricane, the original intention being that by such simple means production would be simplified and a range of aircraft provided. The metal-covered wing was found to be slightly lighter than its fabric-covered forerunners, and the surface is, of course, more in conformity with the designed wing section.

Hurricane Details

Reference has been made earlier in these notes to the fact that in the structural design of the original Hurricane use was made of constructional methods which had stood the test of time in the Hawker biplanes. The fuselage, for example, is a tubular girder structure, with longerons of circular-section steel tube and bracing struts of duralumin in the rear portion, steel in front. This form of construction is simplicity itself, and joints are formed by plates, bolts or tubular rivets. Assembly becomes largely a Meccano operation. Light wooden formers carry closely spaced wooden stringers over which the fuselage fabric is stretched.

In the construction of the wings one sees traces of the old biplane principle. But complete similarity was impossible, due to the fact that the Hurricane wings carry their load as cantilever beams, so that the stress intensity in the flanges near the root is much greater. However, the spar booms are similar in geometrical shape to those used in the



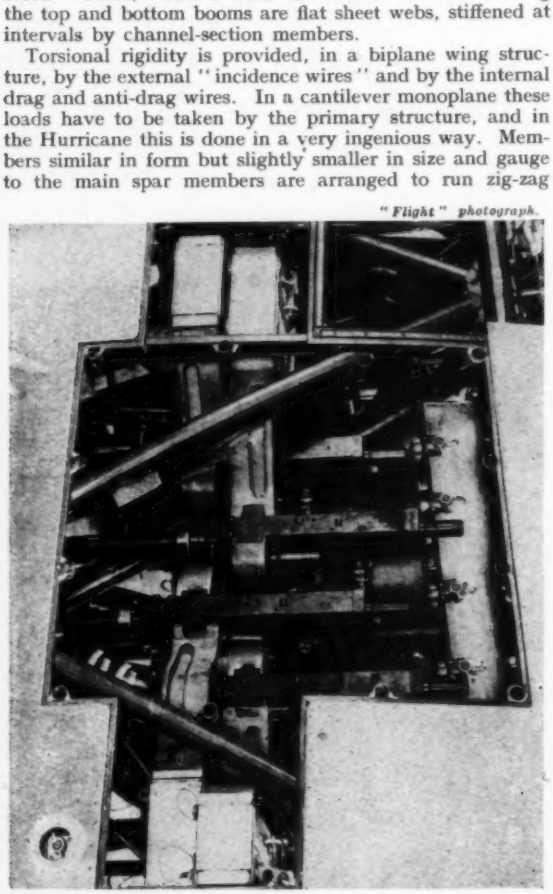
"Flight" photograph.

PRE-WAR VINTAGE: No. 111 (Fighter) Squadron were the first squadron to be re-equipped with Hawker Hurricanes and are seen here in squadron "vic."

biplane wings. That is to say they are polygonal open-sided "bulbs," rolled from flat sheet. Interconnecting the top and bottom booms are flat sheet webs, stiffened at intervals by channel-section members.

Torsional rigidity is provided, in a biplane wing structure, by the external "incidence wires" and by the internal drag and anti-drag wires. In a cantilever monoplane these loads have to be taken by the primary structure, and in the Hurricane this is done in a very ingenious way. Members similar in form but slightly smaller in size and gauge to the main spar members are arranged to run zig-zag fashion between the spars, to which they are attached by horizontal bolts passing through forgings. These zig-zag members perform two functions: they provide the drag bracing, and at the same time they turn the wing into a torsionally stiff structure. The Hurricane wing is, in fact, tremendously strong, and although the original design called for a loaded weight of 5,700 lb., the latest version may safely be loaded to more than 7,000 lb. The current Mark I weighs 6,600 lb.

"Flight" photograph.



In the case of the metal-covered wings, the two main spars have flanges of extruded π section and flat sheet double webs. Towards the tip the section is cut down to a T-section flange and a single web. The diagonals in the gun bay have T-section flanges and plate webs. Outboard of the gun bay there are auxiliary spars and stringers, and the covering is carried on ribs of channel section, pressed from sheet.

When the Hurricane was designed, there was little information about retractable undercarriages. It is thus all the more remarkable that the type designed has been singularly trouble-free in service. The main components are a Vickers oleo leg carrying Dunlop wheels and tyres. To make the wheels clear the front spar when retracted, a peculiar off-centre arrangement of the hinges has been necessary. How this works will, perhaps, be most easily understood by studying the sketch on page *h*. Dowty hydraulic rams are used for operating the undercarriage retraction. In addition there is a hand-operated control, and should both this and the power-driven systems fail (through damage by machine guns, for example) the pilot can turn certain cocks to release the pressure in the hydraulic system. The wheels will then fall into the extended position under the force of gravity.

What has helped the Hurricane to become such a formidable fighter, apart from its good performance and excellent manœuvrability, is its armament of eight Browning 0.303 machine guns. They are mounted, four on each side, inside the wings, just outboard of the undercarriage. This arrangement avoids the necessity for the interrupter gear which was used on the older fighters to enable the guns to

PUNISHING POWER: The ammunition boxes, feeds and four Browning guns which constitute the armament of one wing of the Hurricane.

THE HAWKER HURRICANE (CONTINUED)

"Flight" photograph.

LONDON DEFENCE: A squadron at an aerodrome close to London was one of the early recipients of Hurricanes and used to thrill the crowds on Empire Air Day.

be fired through the airscrew disc without damage to the blades. The guns are, of course, remotely controlled from the pilot's cockpit. In this connection it is interesting to point out that the recoil of the eight guns is sufficient to slow down the machine perceptibly.

As the Hurricane is designed for both day and night fighting, it carries very complete equipment, including Harley landing lights and navigation lights. Two-way radio is, of course, provided, and much other gear.

The Power Plant

The engine which has made our single-seater fighter performances possible is the Rolls-Royce Merlin. As explained earlier, the prototype Hurricane had the type "C," of 1,025 b.h.p. at 15,000ft. This was followed by the Merlin II, and the latest version of the Hurricane, Mark I, has the Merlin III, which is rated at 1,030 b.h.p. It is of the 12-cylinder vee type, and is glycol cooled, the cooler being carried in a duct below the belly of the fuselage, where it derives the greatest benefit from the airscrew slipstream. Cooling is controlled by a flap at the rear end of the duct. The Merlin drives a three-bladed variable-pitch airscrew, the earlier machines having the De Havilland and later models the Rotol with wooden blades set in a metal hub.

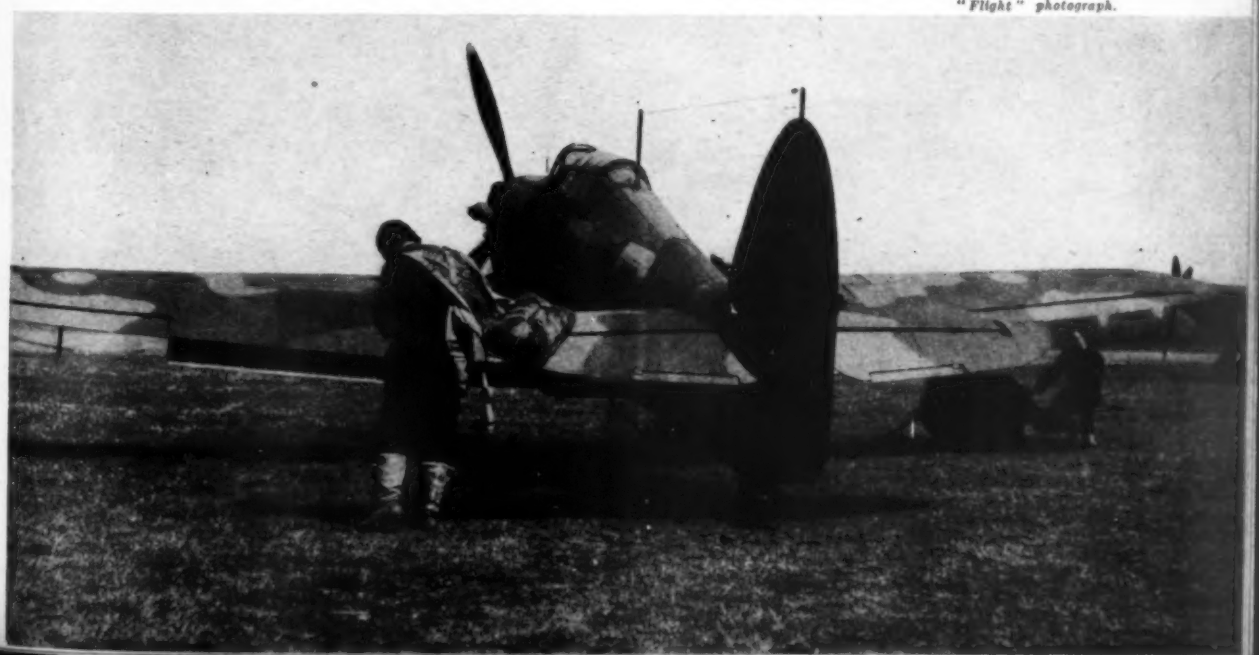
Fuel is carried in three tanks, one of 34.5 gallons in each wing, inboard of the undercarriage, and one of 28 gallons capacity under the deck fairing in front of the pilot. The tanks are protected by armour and rubber.

It is not generally realised that the Hurricane has quite a long range. The full-throttle range is, of course, fairly short, but the machine is so clean that it will remain in the air "on a whiff of throttle," and this fact brings the range up to about 830 miles. Nor is that range achieved at a ridiculously low speed, for the cruising speed corresponding to maximum range is 168 m.p.h. at a height of 5,000ft. It might be argued that this height is too low, but even if it is increased to 25,000ft., and the cruising speed to 230 m.p.h., the range is still about 700 miles, which is rather remarkable.

Most of the equipment carried in the pilot's cockpit is

ALL SET: The pilot dons his parachute while the engine is started by the battery trolley on the right-hand side. Flaps are already in the take-off position so that no time is lost. The aerial arrangement is clearly shown with the rear post directly over the rudder hinge line. On the elevator are seen the fixed and movable trimming tabs.

"Flight" photograph.



"Flight" photograph.

RECONDITIONED: Sturdiness and ability to take punishment are characteristics of the Hurricane, and its form of construction enables repairs to be carried out quickly. This type has a Rotol airscrew with wooden blades.

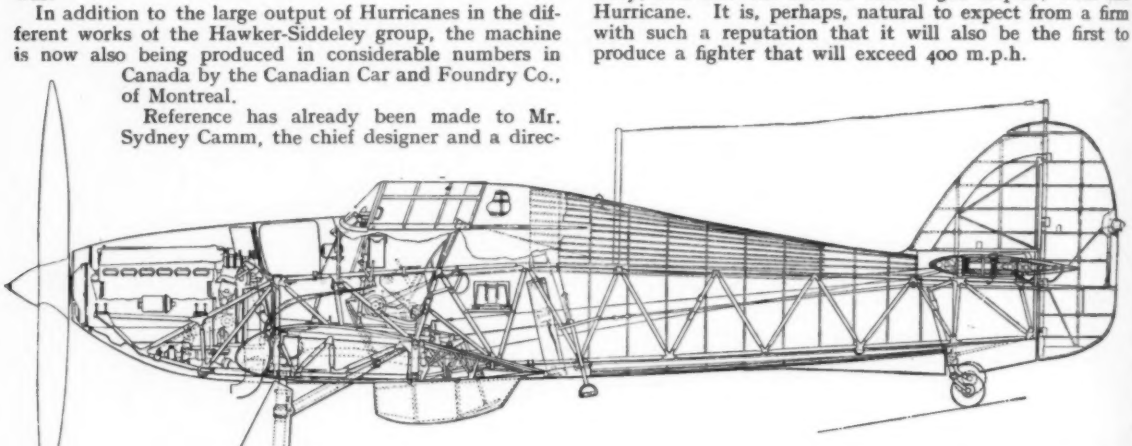
THE HAWKER HURRICANE (CONTINUED)

shown in our drawing, but special attention may be called to the armour protection for the pilot, and to the bullet-proof windscreen in front of his face. The extra confidence which this protection gives the pilot has been of untold value in aerial combats and has, with the inherently good qualities of the machine, contributed in no small measure to the successes which the Hurricane has achieved in the war.

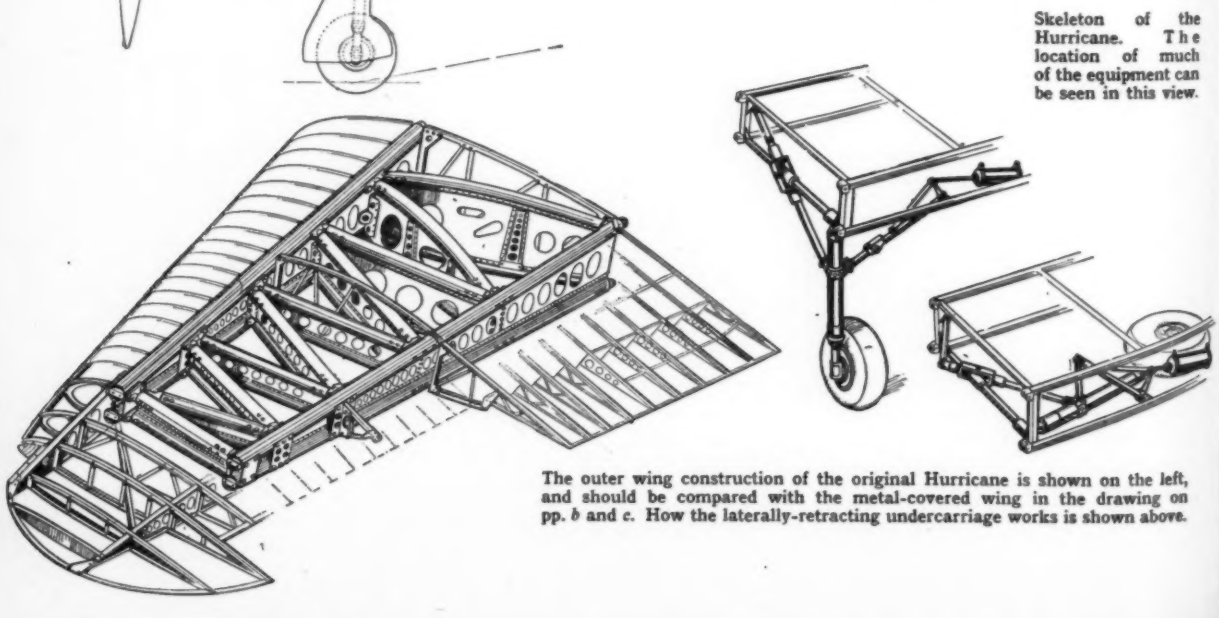
In addition to the large output of Hurricanes in the different works of the Hawker-Siddeley group, the machine is now also being produced in considerable numbers in Canada by the Canadian Car and Foundry Co., of Montreal.

Reference has already been made to Mr. Sydney Camm, the chief designer and a director of the company. To him must obviously be given most of the credit for the long view and foresight which produced such an excellent aeroplane so long ago. But he would be the first to insist that his technical staff should share the honours with him. The staff is a large one, and it would be impossible to mention all. However, we feel that at the very least the names of Messrs. R. H. Chaplin, S. D. Davies, R. McIntyre, and R. Lickley should be brought into this account of the birth and growth of the Hurricane.

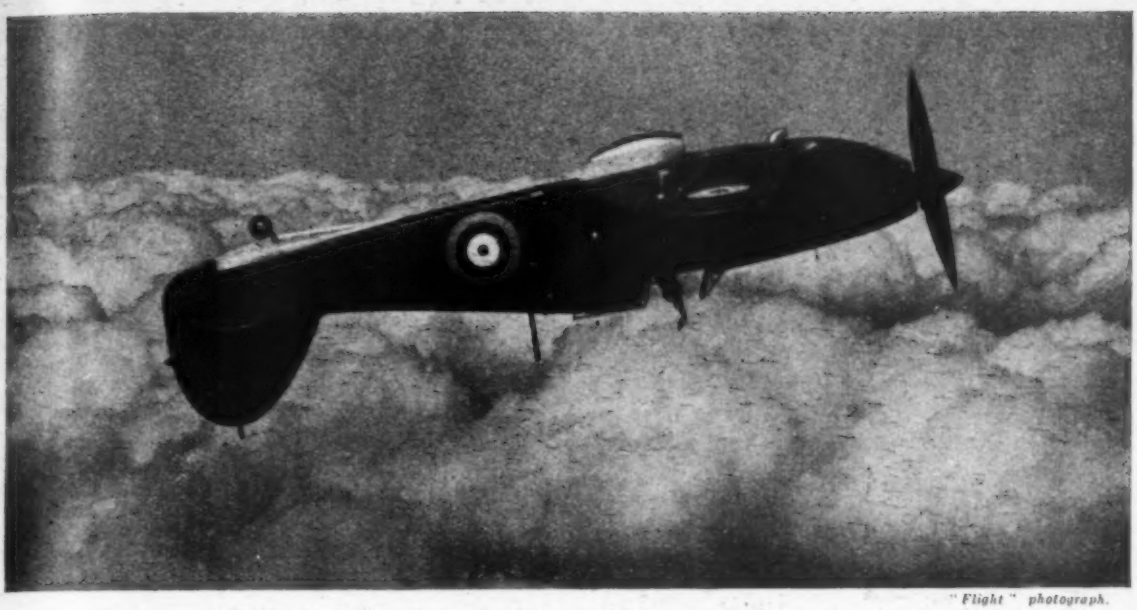
Finally, it is of interest to recall that the Hawker company was the first to produce a 200 m.p.h. fighter, the Fury, and also the first to exceed 300 m.p.h., with the Hurricane. It is, perhaps, natural to expect from a firm with such a reputation that it will also be the first to produce a fighter that will exceed 400 m.p.h.



Skeleton of the Hurricane. The location of much of the equipment can be seen in this view.



The outer wing construction of the original Hurricane is shown on the left, and should be compared with the metal-covered wing in the drawing on pp. *b* and *c*. How the laterally-retracting undercarriage works is shown above.



"Flight" photograph.

NICE FLYING ANYWAY: The Hurricane has all the good flying qualities expected of a Hawker machine.

THIS IS THE HURRICANE

"Indicator" Records His Impressions of Flying a Nice Aeroplane

DESPITE the fact that the Hurricane was designed and originally developed so very long ago, and that there are now quite a number of new and altogether more savagely effective fighters on their way into service, this type will probably retain its special place in the scheme of things for quite a long time to come. Change the word "despite" to "because of" and you have the greater part of the reason why it has been, is, and will continue to be, such a success.

Time is required to bring perfection and to introduce gradually all those improvements which real work, both in peace and in war, prove to be necessary, while the new fighters are following slightly different trends. In short, the Hurricane and the Spitfire, each in its own particular way, are perfect for the work which they now have to carry out and against the types which are at present being used in quantity by the *Luftwaffe*. And they will continue to be perfect for this work while other fighters come on to the scene to perform slightly different functions and to fight rather different battles.

Since it was the first of its type, the Hurricane will always be remembered with special affection by those within the aircraft industry, on its fringes, and in the R.A.F., even when the war has produced other and much more remarkable aeroplanes. It seems to be a very long time ago that this machine first came into the limelight with a somewhat remarkable flight from Turnhouse to Northolt. Gale or no gale, it was a tremendous performance to average more than 400 m.p.h., and a still more tremendous performance to average this speed at night when the general public still looked on modern fighters as machines which should only be flown in the best possible conditions and had hardly realised that night flying was done by machines other than those used for long-range bombing and air transport, these necessarily carrying a suitable crew. The thought of one man alone behind a thousand horse-power and travelling at 400 m.p.h. at night gave us some new ideas.

In those days, too, the ordinary pilot outside the Service did not realise that such a high-speed night cross-country was normally possible largely because of the innate excellence of the Hurricane as a machine. It was not until more or less ordinary mortals were poured into the cockpits of these fighters and set off casually for delivery trips that the superman-test pilot idea began to fade. It has reappeared again, of course, with new and faster types, and will probably die in the same way. Once upon a time the Hart was considered to be the last word in military machines, to be flown only by the magnificently fit and well trained, and it is now treated as a sort of joke to be handled by pilots who are not yet fit to deal with anything more splendid.

Yet there is no doubt that, once the control drill of the modern type has been mastered, the Hurricane is a great deal easier to fly than the Hart or Hind. The only difference is that it is rather more lethal because of its higher wing loading and loses speed rather more quickly during an approach and landing because of that comparatively recent invention, the flap, without which no modern type could be flown. Incidentally, few modern types could be flown without some form of controllable pitch airscrew, and it says much for the design of the Hurricane that it was produced before such airscrews were reasonably available and was thoroughly effective in service without such an aid to take-off and climb.

A Private Theory

A nice compromise in wing loading and airscrew pitch was arranged, and this compromise has helped to make the Hurricane a fighter of all-round merit. Without the necessity for such consideration it might have been just a little on the "hot" side, and not, therefore, so suitable for handling by pilots with very little previous experience of high loadings—nor so suitable, either, for work in rough-and-ready conditions. One of my private theories about the development of air war is that whatever the advances in design, there will always be uses for improved versions of obsolescent types. Sooner or later it will be necessary to fight from a terrain where aerodromes are poor or non-existent, or where all the aerodromes have been effectively but not completely destroyed on both sides of the line. Then the advanced types will be grounded and the older

"Flight" photograph.

?. FEET PER SEC. : A Hurricane diving through a cloud layer.

THIS IS THE HURRICANE (CONTINUED)

types will come into their own. One can cite one phase in the Norwegian campaign as a case in point. For the short time during which it was possible for them to do so a squadron of Gladiators did sterling work. No other modern fighter type could have functioned from the "aerodrome" concerned.

Very often before I have remarked that the best thing to be said about any aeroplane is that it is easy to fly, and that the present British fighting types have that virtue—the Hurricane, particularly, among them. When I first left the ground in one of these machines—with a due and inevitable feeling of incompetence and personal danger—I had previously put in a bare three hours on types which might reasonably be considered as fighter trainers, the Harvard and the Battle. The former to teach me something about undercarriages, flaps and c.s. airscrews, and the latter to give me an idea of the feeling of a thousand horse-power, and to make the broad, long, tabletop cowling with its exhaust stubs on either side a little less terrifying.

I confess that my first impressions of the Hurricane were of dust storms, acceleration and violent rudder corrections. Before I had properly gathered my wits the machine was in the air and I was fumbling with the U/C retraction gear and its safety catch. The dust storm was the result of leaving the hood open according to instructions, the acceleration was the result of a too careless use of plus six boost, and the rudder corrections were quite unnecessarily vigorous.

At that time I was not by any means used to going quickly, and by the time I had lowered my seat, closed the hood, completed the undercarriage retraction, reduced boost and changed to coarse pitch—Hurricanes had two-position airscrews in those days—I was dashing along over entirely unfamiliar country at 200-odd and on a compass course which I hoped was correct. Of course, I hit a familiar landmark in due time (one always does) but it seemed to me then that it was a bit early in my flying career with military types to be forced landing for no good reason. After that I learnt, at least in a strange machine, to get everything set and fair before leaving the aerodrome. A Hurricane, in particular, turns by itself, and there is no hardship in making a circuit or two. Perhaps I wanted to impress everyone with my enthusiasm and confidence. I've forgotten.

Not that these modern types are

"Flight" photograph.

FOR YUGOSLAVIA : A Hawker test pilot putting a Yugoslav Hurricane through its paces.

THIS IS THE HURRICANE (CONTINUED)

particularly terrifying in forced landings. If you have some engine left and if there are any good fields to be found in these days of projected parachute troops, you find one and carry out a normal landing. If the engine stops you just leave the undercarriage up and make the best of a bad job in any sort of open space which is facing one as the machine is turned into wind. Apart from the incidence of houses, chimneys, trees and telegraph posts a modern machine with its undercarriage up will skate and crash through almost anything without turning over and generally without damage to the pilot, while the old-fashioned affair with a spindly fixed undercarriage almost invariably turned over unless the chosen field was well-nigh perfect. If we return to fixed undercarriages for certain types—and there is a lot to be said for them—these must be instantly detachable in emergency. In fact, the idea might be applied to all types, though instantaneousness is important because it might only be discovered at the last minute that a certain chosen field is unsuitable.

Cockpit Layout

Although it is necessarily "bitty" according to present-day standards, the layout of the Hurricane is a good one, with most of the items where you would expect to find them. In older types there was a certain inconvenience in undercarriage and flap operation, since after selection through the gate it was necessary to hold down a "power" lever until the operation had been completed—which involved flying with one's left hand and leaving the throttle and airscrew controls, not to mention the trimming wheel, to their own devices for a matter of ten seconds at rather critical periods. Nowadays mere selection produces the results—the gate is on the right side of and below the dashboard with the flap indicator near it.

One curiosity about the Hurricane is that the ailerons do not stiffen up as one would expect them to do when the speed increases. They remain quite reasonably light and very potent, at least up to the sort of speeds at which one normally makes use of them. Yet at no time are they too light and they still continue to work down at the bottom end of the scale. The normal approach speed seems to be about 90 m.p.h., but one can safely come in a great deal more slowly than that if engine is used right down to the ground and during the holding-off process. All you really need is sufficient speed—or power—to give time for a controlled hold-off and to prevent the possibility of a stall and heavy wing-down landing while the machine's attitude is being changed from a steep glide to a fairly pronounced tail-down position on the ground. With a straight approach there is really no need for much speed with any machine, and in giving oneself plenty of margin one is only preparing for the worst and for the forced-stall effect of vigorous elevator movement at the last moment. Hence, largely, the rumble approach.

The most important features of the Hurricane as an operational type are probably the good view from the pilot's seat and the natural sturdiness on the ground. Even during the process of landing, the ground can always be seen, and the Hurricane will take rough handling, both when landing and taxying, better than most. Hence its particular value as a front-line fighter operating from fields which have been torn up by bombs and gunfire, or which are, in any case, small and badly surfaced. A great many pilots will be unhappy if the Hurricane ever goes out of service, even in the distant future. INDICATOR.

DICK REYNELL

IT is with very profound regret that *Flight* records the death in action of Flt. Lt. R. C. Reynell. With a career just at its beginning, he had already shown qualities which would have taken him far, had not his life been taken at the early age of 28.

An Australian by birth, Dick Reynell joined the Oxford University Squadron in 1929 and the R.A.F. in 1931. He became test pilot to Hawker Aircraft, Ltd., in 1937, and soon proved to have all the qualities needed in a test pilot. His technical knowledge was far above the average, and he was full of new ideas; yet he never took offence nor became discouraged if any of his suggestions were turned down.

As a demonstration pilot Dick Reynell was superb. No one who had the good fortune to witness it is ever likely to forget his performance on the Hurricane at the Brussels Show before the war. The Germans and French had been demonstrating their machines, and the crowd had applauded. Then Dick did incredible things with his machine, and the spectators gasped. His judgment of speed and height was perfect. It is not on record what General Milch and other Germans thought of the demonstration, but it must have given them a very uneasy feeling to see what could be done with a Hurricane, and they would undoubtedly compare it with their own Messerschmitt, the limitations of which they knew.

It must not, however, be thought that Dick Reynell was merely a showman. Nothing could be further from the truth, but he loved to do everything really well, and his demonstration work called for the highest degree of skill and accuracy in flying. How he applied that skill is, perhaps, best shown by a single example, which is typical of the man. The Hawker company was, once upon a time, somewhat concerned about the airflow around the wing fillets and radiator fairing of a new experimental type. Flying a Hurricane close below the experimental aircraft, Dick "formated" on it long enough to take a series of photographs, using one hand to work the camera and the other to pilot the Hurricane. These photographs showed the behaviour of wool tufts very clearly and gave the designers the information they were after.

Our Chief Photographer, who has flown with him on many occasions, has always been most enthusiastic about his understanding of the flying necessary to secure a photograph of a particular manœuvre. It was in this kind of flying that his exceptional judgment of speed and distance was turned to good purpose. He was piloting when the picture of the Yugoslav Hurricane on page 372 was taken. The whole idea of this picture was a straight climb to give some idea of the reserve of power of a modern aeroplane; it took Dick to improve matters by coming up skating on one side, thereby adding to the value of the photograph.

One of Dick Reynell's closest personal friends has sent us the following: "I have yet to meet a finer character, nor have I ever known anyone who threw so much energy into whatever he turned his hand to, whether it was flying, aeronautics, ski-ing, sailing or any other subject, problem or hobby. He never seemed to let anything get him down, and he had to go on until he knew as much about the job as anyone else. His energy was unbounded; he took an almost childish delight in his successes, and was incapable of conceit of any kind."

Reynell leaves a widow and a baby son, to whom we extend our sincere sympathy.

HERE and THERE

Mr. C. R. Fairey

MR. C. R. FAIREY, who went to the United States some time ago, has made his services available to the British Purchasing Commission as adviser to its aviation representative, Sir Henry Self.

Next Week's Issue

OWING to so much of our space in this issue being devoted to the Hurricane, we are unable to include the usual "Aircraft Engineer" supplement. This feature, together with the fifth of the Enemy Aircraft series, the Mercedes-Benz DB 601A engine, will appear in *Flight* next week.

P.A.A. Trains Army Navigators

PAN AMERICAN AIRWAYS has been requested to set up a school for the training of navigators for the U.S. Army Air Corps, and the school has been established at Miami, Florida. Students wishing to enter must have had two years of college and be between the ages of 20 and 27. More than half of the first class of 50 were found to be college graduates, and this class will complete its instruction in 12 weeks. Thereafter a gradual expansion up to 200 students constantly being taught will occur. The day will be allotted into 4 hours' navigation, 1 hour meteorology, 2 hours' military training, and 2 hours' homework.

Bombay Flying Club

THE flying time for the Bombay Flying Club for July was very much above that for the same month last year, being 221 hours, an increase of 142 hours. All except 11 hours of this time was flown in Poona, July not being a month of good flying weather in Bombay. Five new members have joined the club, and five others made their first solo flights during the period. In addition, training for the Air Force and for instructors' certificates goes on, and some army co-operation has been successfully carried out. A new Tiger Moth has arrived from England, and after test flying for its certificate of airworthiness is in Bombay awaiting transfer to Poona.

Lockheed Wind Tunnel

TO facilitate the research work necessary in an up-to-date aircraft factory, Lockheed has a wind tunnel under construction which will be capable of speeds up to 260 m.p.h. The test section will be 12 by 8ft., enlarging to 20 by 30ft. at other parts of the air passages. The tunnel is of reinforced concrete, and will be housed in a building 170 by 70ft. Power is provided by a six-bladed airscrew driven by a 1,500 h.p. motor.

All the sections of the tunnel have been made rectangular in order to reduce cost. To keep the operating temperature at 110 deg. F. or less, the corner guide vanes will be water cooled.

The balance is 34ft. high, and is mounted on a concrete base weighing 60,000 lb. Hydraulic controls will be provided to change the angle of attack of the model, and the balance readings will be transmitted electrically to a large panel, so allowing the indications to be photographed simultaneously.

To aid in design, a model was first built to a scale of one-eighth. A 40 h.p. motor was used to drive the airscrew, and power was measured by a torque dynamometer. By this means experiments with different shapes of corner guide vanes were carried out, and the resultant changes of power consumption determined. The setting of the guide vanes was also facilitated to such an extent that it was possible to keep the uniformity of air speed at the throat to within 0.25 per cent. of the average. The model will afterwards be used as a small tunnel for test work. The building houses other research facilities, and the whole project is costing $150,000.

Irish Aircraft Fund

LORD RUSSELL OF KILLOWEN will be president of a committee of Irishmen in Great Britain which has been formed for the purpose of raising money to buy aircraft. The headquarters of the committee will be at 5, St. John's House, Smith Square, S.W.1, and the honorary secretary is Sir Patrick Hannon, M.P. Subscriptions may be sent to the National Bank, Limited, 13, Old Broad Street, London, E.C.2, or to the West End branch at 15, Whitehall, S.W.1.

Contributions for aircraft continue to come in from many sources, both home and overseas, in thousands and thousands, and the total must be approaching one day's war expenditure.

U.S. Exports for July

DURING the month of July, Great Britain obtained from U.S.A. a total of 173 aeroplanes at a cost of $12,776,643. In addition, 77 engines were bought for the sum of $940,414. Canada was the next largest buyer with 87 aircraft for $1,851,005, and 315 engines for $2,520,310.

Other figures given by *American Aviation* show that the total U.S. exports included 305 landplanes with engines ($14,117,517); 23 landplanes for assembly abroad ($1,945,018); 7 seaplanes and amphibians ($499,544); 437 engines ($3,829,135). Other amounts, small in comparison, were spent on engine and airscrew parts, instruments, parachutes, and other accessories.

The first four purchasers on the list in order of magnitude were: United Kingdom ($14,338,191); Canada ($4,905,461); China ($1,350,477); Portugal ($463,416).

South Across the Atlantic

PAN AMERICAN AIRWAYS are seeking the approval of the Civil Aeronautics Board to the use of an extreme southern route during the winter for their Atlantic crossings. They wish to fly via Bolama, in Portuguese Guinea, on the west coast of Africa, across the Atlantic to Port of Spain, in Trinidad, the British possession just off the north coast of South America. From there the route will turn northward across the Caribbean Sea to San Juan, in Puerto Rico, and then on to New York. If weather is bad, Baltimore, Maryland, or Charleston, South Carolina, may be used. The crossing from Bolama to Port of Spain is about 3,100 miles.

Pratt and Whitney Extends

THE Pratt and Whitney aero-engine factory at Hertford, Connecticut, is having two large buildings added to it which will cover 400,000 sq. ft. of floor area. Maj.-Gen. H. H. Arnold was present at a recent ceremony on the site. The additions have been financed by British capital, and are known as the "British addition."

Two years ago the maximum capacity of the Pratt and Whitney plant was about 250,000 h.p. per month. Early next year it is expected that capacity will be over 1,000,000 h.p. per month, a large amount of which will be available for export to England.

EX CATHEDRA: Pupils at the Bolton Spotters' Training School studying German aircraft outlines from a chart specially prepared by *Flight* for the Air Ministry.

SERVICE AVIATION

The late Air Vice-Marshal Charles Hubert Boulby Blount, C.B., O.B.E., M.C.

Air Vice-Marshal C. H. B. Blount, C.B., O.B.E., M.C.

WITH great regret we have to record the death in an air crash on Oct. 24 of Air Vice-Marshal Blount, C.B., O.B.E., M.C. *Flight* has happy memories of this officer, who was Commandant of the School of Army Co-operation at Old Sarum when our representatives visited the school in 1934. They were much impressed by the personal charm of the Commandant and by the clear and somewhat original views which he held on the subject of air co-operation with the Army. He was, in fact, outstandingly an army co-operation man, though he had naturally served as well in other branches of the R.A.F. Before the last war he was a regular officer in the Queen's (Royal West Surrey Regt.) and was seconded to the R.F.C. in 1916. By the spring of May, 1918 he had risen to be temporary Lieut. Colonel at the age of 24, and had won the Military Cross and three foreign decorations. He transferred to the Royal Air Force with a permanent commission in the rank of Squadron Leader. In 1920 he was C.O. of No. 4 (Army Co-operation) Squadron at Farnborough and played a prominent part in the Army manœuvres of those days, doing much to establish the methods by which air reconnaissance could help the Army staff. In 1922 he took his squadron to Constantinople. He did his turn of duty overseas, and passed through the R.A.F. Staff College. In the present war he was A.O.C. the Air Component of the Expeditionary Force in France.

Indian Pilots Honoured

TWENTY-FOUR Indian officers of the R.A.F. have visited Windsor Castle and have had the honour of taking tea with the King and Queen. They were entertained the same evening at the Over-Seas Club, St. James, by Mr. E. S. Rungnadhan. Most of their initial training has been done in India, and they will be posted for active service on completion of advanced training here.

Awards

THE KING has been graciously pleased to approve the undermentioned appointments and awards, in recognition of gallantry and devotion to duty in the execution of air operations.

COMPANION OF THE DISTINGUISHED SERVICE ORDER.

Act. Wng. Cdr. J. E. C. G. F. Gyll-Murray.

MEMBER OF THE MILITARY DIVISION OF THE MOST EXCELLENT ORDER OF THE BRITISH EMPIRE.

F/O. D. P. Bamber.

BAR TO THE DISTINGUISHED FLYING CROSS.

Act. Flt. Lt. R. A. Cruickshank, D.F.C.

DISTINGUISHED FLYING CROSS.

WING CDR. R. A. T. STOWELL (Middle East Command).—Since the outbreak of war with Italy Wing Cdr. Stowell has led his squadron against the enemy on 38 occasions, often attacking his objectives after having forced his way past superior numbers of enemy fighters. His leadership has inspired his squadron with high morale, and he has shown exceptional valour, courage and devotion to duty.

MAJOR R. H. PRELLER, South African Air Force (Middle East Command).—While carrying out a reconnaissance and attacking an enemy aircraft on the ground, Major Preller was shot down in the desert in enemy territory 70 miles from the border. He destroyed his aircraft and proceeded to walk to British territory accompanied by his crew of two, who eventually became exhausted. He left them at a water hole and proceeded alone to seek aid. After 14 days, having suffered terrible hardships through lack of water and food, he made contact with British forces, and was able to give directions which led to the rescue of his crew and the recovery of a very valuable exposed film of enemy military objectives. This officer has shown marked determination in individual operations, and in leading his squadron he has imbued them with his own fighting spirit to a remarkable degree.

P/O. J. A. BARKE (Middle East Command).—This officer has taken part in 25 raids during the past two months, on each of which he has shown marked courage and determination. When carrying out a reconnaissance he was intercepted by enemy fighters and had the petrol and oil tanks of his aircraft pierced and his rear gun put out of action. By most skilful flying and the display of great courage and determination he out-manœuvred the enemy and landed at his base with only one engine running, thus undoubtedly saving the lives of his crew. His conspicuous gallantry has at all times set a fine example to the other flying personnel.

Wing Cdr. L. R. Stokes, Act. Wing Cdr. R. B. Lees, Sqn. Ldr. N. W. D. Marwood-Elton, Act. Sqn. Ldr. T. S. Rivett-Carnac, Act. Sqn. Ldr. J. B. Tait, Flt. Lt. A. W. Fletcher, Flt. Lt. H. M. Mitchell, Act. Flt. Lt. G. O. L. Bird, Act. Flt. Lt. W. H. George, Act. Flt. Lt. H. E. Hopkins, Act. Flt. Lt. J. P. Hopkins, Act. Flt. Lt. A. L. G. Hubbard, Act. Flt. Lt. S. N. L. Maude, Act. Flt Lt. S. A. Middleton, Act. Flt. Lt. V. Mitchell, Act. Flt. Lt. J. D. Warne, F/O R. C. Bissett, F/O. W. J. Burnett, F/O. I. G. O. Fenton, F/O. B. G. Meyer, F/O. A. J. Oettle, F/O. W. N. Perioli, F/O. J. S. P. Phillips, F/O G. W. Prior, F/O. R. V. Warren, F/O. E. P. Willcox, F/O. R. S. C. Wood, P/O. L. Bennett, P/O. H. Gandy, P/O. L. Graves, P/O. J. S. Higgins, P/O. D. W. Holford, P/O. W. J. Lewis, P/O. I. R. McDiarmid, P/O. A. J. G. Mills, P/O. A. M. Paape, P/O. J. F. Painter, P/O. G. A. C. Potts, P/O. H. K. Wakefield, P/O. G. P. Watson, P/O. D. M. Wellings.

ROYAL AUSTRALIAN AIR FORCE.

Sqn. Ldr. W. H. Garing.

ROYAL NEW ZEALAND AIR FORCE.

Act. Flt. Lt. J. Adams, F/O. T. O. Freeman, F/O. W. H. Coleman.

DISTINGUISHED FLYING MEDAL.

Flt. Sgt. L. F. East, Flt. Sgt. N. H. Webb, Sgt. E. R. Abbott, Sgt. E. W. Applebee, Sgt. R. Bailey, Sgt. K. C. A. Ball, Sgt. C. Banham, Sgt. D. S. Barnes, Sgt. E. Binks, Sgt. H. S. Blakeman, Sgt. A. H. Bolton, Sgt. G. M. Brisbane, Sgt. J. Bryce, Sgt. A. R. Cadman, Sgt. P. J. Camp, Sgt. A. Cody, Sgt. F. R. Connor, Sgt. S. H. Conway, Sgt. B. A. Curtis, Sgt. T. W. Donoghue, Sgt. P. K. Eames, Sgt. K. F. East, Sgt. D. N. Fielding, Sgt. G. T. J. Fomison, Sgt. J. Friendly, Sgt. E. Greenwood, Sgt. J. P. Hayes, Sgt. A. J. Hawkins, Sgt. H. J. H. Kitson, Sgt. W. S. Kitson, Sgt. P. H. Lucas, Sgt. D. A. W. McFarlane, Sgt. R. R. Megginson, Sgt. G. H. Miller, Sgt. J. H. Moutray, Sgt. J. W. Murray, Sgt. C. A. O'Donnell, Sgt. H. J. Parker, Sgt. D. Parr, Sgt. L. A. Paskell, Sgt. S. A. Patterson, Sgt. R. Perkin, Sgt. S. Robinson, Sgt. H. Robson, Sgt. K. J. Sewell, Sgt. J. O. N. Smith, Sgt. R. W. Smith, Sgt. I. C. K. Swales, Sgt. F. G. E. Tizard, Sgt. J. H. Walker, Sgt. W. Wilson, Sgt. D. T. Witt, Act. Sgt. W. A. Allinson, Act. Sgt. A. H. Bird, Act. Sgt. C. King, L.A/C. J. E. G. Allwood, L.A/C W. R. Rich.

SGT. F. BAVIN-SMITH (Middle East Command).—Sgt. Bavin-Smith has taken part in numerous raids over enemy territory, successfully navigating the formation, controlling the fire of less experienced air gunners and taking photographs of targets often under intense fire. In June, 1940, during a raid on enemy positions, when observer in the leader's aircraft, despite being attacked by four enemy fighters, Sgt. Bavin-Smith rapidly produced the requisite course, and enabled the formation to withdraw without loss. Two fighters were shot down in the engagement. He is cool, level-headed and courageous, and his determination has inspired the other air gunners in his squadron to maintain their high standard of morale.

SGT. J. J. W. MILDREN (Middle East Command).—This airman has been the air observer in the leading aircraft on all raids made by the squadron since the commencement of hostilities. In June, 1940, when attacking an enemy aerodrome, Sgt. Mildren proceeded with difficulty, in a cramped position, and in face of enemy opposition, to obtain excellent photographs of the target, showing the exact location of the bomb bursts and many other important details on the enemy aerodrome. He then operated a gun firing through the camera hatch, and gave a most lucid, calm and helpful description of the fight to the leader. When the starboard petrol feed was severed, and half the petrol had gone into the fuselage, he did his utmost to check the leak and assisted the pilot with fuel calculations. His actions eventually resulted in the safe return of the aircraft to its base. He has shown coolness and courage in many active operations against the enemy, and is a well-balanced and thoroughly dependable member of his unit.

Royal Air Force and Fleet Air Arm News and Announcements

London Gazette

Royal Navy

Act. Sub. Lt. (A) P. H. Moss to be Sub-Lieutenant. (A) (Aug. 7.) To be Tempy. Sub-Lieutenants: (A) R. Towers (March 10), D. G. Andreoli (March 26), H. G. R. Molet (March 23).

Royal Air Force

General Duties Branch.

The undermentioned are granted temporary commissions as Pilot Officers on being employed with the Royal Air Force:—(Sept. 28) G. B. Penman, Lt., R. Scots; I. A. Seggie, Lt., R.A.; J. T. Brown, Lt., Durham L.I.; R. E. Young, Lt., R.E.; D. Higson, 2nd Lt., R.A.; J. K. Charles-Jones, 2nd Lt., Mon. R.; A. G. Fairhead, 2nd Lt., R.A.; A. S. Robertson, 2nd Lt., R.A.; M. L. Marsh, 2nd Lt., R. War. R.; H. G. F. Larsen, 2nd Lt., R.A.; D. Rowcliffe, 2nd Lt., D.W.R.; R. B. O'H. Warburton, 2nd Lt., R.E.; G. I. Lewis, 2nd Lt., Mon. R.; D. A. Andrews, 2nd Lt., R.E.; F. C. G. Wilson, 2nd Lt., R.A.; K. H. Bayley, 2nd Lt., Essex R.; S. Bowes, 2nd Lt., The Queen's R; (Sept. 30) M. C. B. Anderson, 2nd Lt., R.T.R.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Flight Sergeants: (Sept. 6, Sen. Aug. 26) S. L. Treves; (Sept. 12, Sen. Sept. 2) F. Brannam; (Sept. 16, Sen. Sept. 2) J. M. O'Brien; (Sept. 30, Sen. Sept. 11) J. F. Clayton; (Oct. 3, Sen. Sept. 25) F. J. Soper. Sergeants: (July 13) R. C. Beale; (Aug. 9, Sen. Aug. 7) J. S. Higgins; (Aug. 31, Sen. Aug. 30) W. Arnott, W. L. Sproston; (Sept. 20, Sen. Sept. 11) E. W. Batchelor; (Sept. 21, Sen. Sept. 11) H. R. Rittey, Temp. Sergeant: (Sept. 19, Sen. Aug. 28) W. R. Smith.

The undermentioned Pilot Officers on probation are confirmed in their appointments:—(March 6) F. B. Bassett; (June 29) R. T. R. Cowper; (Aug. 1) N. H. J. Smith, A. G. Wright; (Aug. 6) K. J. Masters; (Aug. 8) J. F. Bendix, H. J. W. Black, J. W. E. Bridger, C. F. A. Canon, G. G. F. Draper, W. H. Dunne, E. R. Edmunds, B. H. Evans, J. J. Fisher, J. H. Green, F. W. Hillman, C. L. G. Holmes, J. H. D. Keates, B. H. McMichael, T. R. Murfitt, B. P. O'Duffy, E. D. Osborn, F. R. W. Palmer, L. F. Penny, D. Peveller, R. M. Pinkham, M. V. Redfearn Smith, P. J. E. Ritchie, T. D. I. Robison, J. T. Russell, F. W. H. Simpson, D. A. Thomas, B. R. M. Waite, G. M. Wiltshear, G. Wright; (Aug. 14) D. F. Benbow, W. G. Bennett, A. E. Bigelow, G. C. H. Birchall, P. Bray, B. T. Brigg, R. R. Briscoe, D. L. Clarke, P. G. Cooper, M. A. Coote, J. T. Crossey, W. C. Dallin, F. G. de Sieyes, C. E. Dewar, R. B. Dewey, W. H. Dimmock, R. R.

MIDDLE EAST MISCELLANY: A French pilot, serving with the R.A.F. in the Western Desert, who has his own Morane 406. The 20 mm. Hispano shell gun can be seen projecting through the airscrew hub.

Drew, R. C. Ensign, A. J. Farie, R. S. Gaskell, H. T. Gilbert, R. F. Harman, J. Hurry, G. B. W. Jobling, A. L. Jones, J. J. P. Kenny, W. S. Longhurst, R. M. McT. D. Lucas, A. G. McAfee, G. McKenzie, M. M. Mair, R. F. S. Marriott, H. E. Martineau, R. A. E. Milton, T. G. Moore, A. K. Ogilvie, D. A. Payne, D. E. F. Powell, E. F. Publicover, R. M. Pugh, J. W. Rae, E. O. Richards, J. M. Rumsey, F. W. F. S. Russell, N. D. Sinclair, I. A. Slaughter, D. A. Smith, R. W. Smith, J. F. Soden, W. R. N. Sturdy, M. F. Suckling, C. F. Sutcliffe, P. A. W. Thomas, A. M. Todd, R. E. Troward, R. A. Ullman, D. P. Watson, K. G. Webb, G. H. A. Wellum, D. A. White, J. S. Wigglesworth, J. G. Yates; (Aug. 19) A. McFadden; (Aug. 21) H. C. Winter-Taylor; (Aug. 24) H. B. Allan, J. C. R. Clarke, J. K. M. Cooke, D. Y. Douglas, G. J. M. Hart, A. Hindley, H. W. E. Lane, J. G. Langford, P. Morcom, R. Mottram, B. Parnell, L. D. Sandes, C. H. Saunders, J. R. Topham, J. S. Watters, E. L. West; (Sept. 11) D. R. Bagnall, A. E. Berry, J. Comar, R. H. Crush, D. G. Dickie, F. K. Gill, R. J. Hannan, H. H. J. Miller, J. B. Robertson, I. S. Smith, N. A. Svenson; (Sept. 12) J. H. J. Sauvage; (Sept. 18) W. B. Christophers; (Sept. 20) W. J. Sipprell, J. L. W. Ellacombe; (Sept. 23) H. L. Marshall; (Sept. 25) J. D. Reardon, N. E. Sharp; (Sept. 26) R. M. A. Lakin; (Sept. 27) J. Cutmore.

Act. P/O. on probation P. Brandon-Tyre is confirmed in his appointment and graded as Pilot Officer (Sept. 7).

Act. P/O. on probation T. R. Gilderthorp is graded as Pilot Officer on probation (Aug. 24).

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(Feb. 1) A. M. K. Phillips; (Mar. 6) J. R. I. Bell; (Sept. 3) D. F. Spotswood; P. D'A. Lister; G. K. Peacock; P. J. Shaughnessy; R. C. Porteous; J. St. J. Thomson; J. A. Coltart; S. McC. Boal; L. Fox; J. E. Pebody, A.F.C.; R. M. Power; A. E. Robinson; F. J. Fenton; K. F. Arnold; K. W. C. Bindloss; M. Wyatt; A. H. Boyd, D.F.C.; G. R. Brady; D. A. Robertson; C. H. Milton; S. E. Bussey; J. C. Archer; L. S. S. Edeson; C. F. Atkinson; B. O. Dias, D.F.C.; D. P. Marvin, R. E. G. Van Der Kiste; P. C. Reit; A. V. Hunter; P. L. Billing; H. St. G. Turner; J. L. Waters; R. F. D. Anstead; R. W. Bungey; J. F. Dilworth; J. B. Garland; C. Bowen-Davies; A. L. H. Barber; W. P. Green; B. W. Currie; J. Harrington; F. Gomersall; G. H. Wherry, D.F.C.; J. G. Hick; W. J. Woods; (Sept. 8) J. A. Sproule; (Sept. 10) D. J. French, D.F.C.; (Sept. 13, sen. Sept. 13, 1939) F. M. Benito Lt. S. Lan. R.); E. J. M. Lang (Lt. Foresters); (Sept. 15) J. K. Rogers; (Sept. 17) R. Lloyd, D.F.C.; (Sept. 20) L. J. W. Felgate; (Oct. 11) G. D. L. Haysom; (Oct. 15) W. A. C. Emmett.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—(May 7) N. C. S. Riddell; (May 29) E. Brand; (June 6) D. N. Milligan; (June 29) K. R. Butler; (July 29) D. V. S. Evans; (Aug. 6) A. G. Wilson, J. E. Lydall; (Aug. 17) D. S. Lindsay, S. R. Kendal, G. W. Thoroughgood, A. Garfoot; (Sept. 3) R. M. C. N. de Lestang, F. R. Graeme-Evans, S. C. Romer, D. E. Hawkins, P. Harris, R. J. Fursman, B. Lewin, A. O. Moffet, G. B. Treasure, R. W. Gair, C. McK. Hill, P. W. Rabone, R. E. Hunter, P. W. M. West, J. R. Canham, M. S. J. Wilton, J. A. Turner, W. E. V. Malins, D.F.C., B. O. Egan-Wyer, G. Grant-Govan, T. R. Pierce, F. M. G. Scotter, W. Shearman, K. J. Heinbuch, G. R. Macdonald, A. W. R. Perry, M. J. Elworthy, T. P. Gibson, J. A. R. M. Reid, D. P. Wade, W. A. Young, D. Dews, C. F. Turner, J. M. Morgan, G. J. C. Hogan, A. Blackwell, P. R. W. Wickham, J. R. Wyllie, S. G. Baggott, D. E. H. Levin-Raw, H. D. Dawlish, P. L. Parrott, J. N. Stacey, J. W. Louw, J. N. Hunt, C. G. Robertson, D. A. Stewart, J. J. Meikle, J. G. Bowie, D. Forward, G. P. Gouge, J. D. Hall, W. Hughes, H. E. Mussenden, H. C. Hilton, A. R. Densham, K. V. Gilling, H. T. Smith, B. G. Mace, M. H. Franklin, J. Tillett, J. E. Preston, J. B. Holgate, P. L. Gordon-Dean, E. W. M. Heale, M. T. Harries, P. R. Wylde, H. C. S. Page, C. C. Proby, G. C. Conran, E. M. Halse, R. G. R. Frazer, C. P. N. Newman, R. C. Patrick, W. Allsopp, A. C. Sutton-Jones, A. V. K. Chaffey, C. L. Green, J. L. Shaw, B. C. Bennett, K. M. Bind, J. W. Bocca, L. J. Ward, R. W. Davy, G. L. B. Harris, D. B. Hodgkinson, C. S. H. McDonald, L. G. A. Buchanan, M. G. Birt, P. Mallalieu, D. N. Forde, G. D. Sproule, G. A. Pettit, R. L. B. Carr, L. J. Hill, W. E. Ogle-Skan, C. A. Lenny, J. C. Ward, A. G. Egerton, J. R. Bloxam, R. G. English, J. C. Paterson, D. P. Crittall, H. Gore, J. R. Johnson, H. J. McClymont, M. E. Pollard, T. F. Kerr, K. M. Laird, J. H. T. Foxton, S. Livingston, A. C. Jones, K. C. Forsythe, D. A. J. McClure, P. H. S. Pilcher, W. A. R. Harris, F. Welburn; (Sept. 23) D. G. Belyea, D. K. Plumb, G. B. Hawes, T. C. Musgrave, D. L. Harvey; (Sept. 27) D. J. Penman, H. G. Edwards; (Sept. 30) A. C. P. Clayton, G. K. Scott, D.F.C., A. J. Simpson, C. E. Staples, G. L. Sinclair, D.F.C., J. C. Hall, D.F.C., C. P. D. Price, D.F.C., H. Davison; (Oct. 2) B. W. Smithers.

The undermentioned Pilot Officers are granted the following antedates in seniority in the substantive rank of Pilot Officer:—(Sept. 27, 1938) J. R. Whelan; (Sept. 3, 1939) M. K. Holland; (Nov. 6, 1939) J. D. Towlson; (Dec. 10, 1939) P. A. Worrall; (Dec. 16, 1939) P. V. K. Tripe.

Air Comdre. A. D. Cunningham, C.B.E. (ret.), relinquishes the acting rank of Air Vice-Marshal (Aug. 1).

Flt. Lt. W. R. Heywood (ret.) is transferred to the Technical Branch (April 24).

Technical Branch.

The undermentioned are granted commissions for the duration of hostilities as Flying Officers on probation:—Warrant Officers: (May 4, sen. Mar. 14) A. W. Cockram; (May 25,, sen. Mar. 14) H. A. Harrison; (Sept. 7, sen. Mar. 14) F. F. W. Chitty.

Administrative and Special Duties Branch.

The undermentioned are granted commissions for the duration of hostilities:—As Flying Officers on probation. Warrant Officers (Sept. 21, sen. May 2) D. Bradley; (Sept. 9, sen. Aug. 27) R. Kiddier. As Pilot Officers on probation: Warrant Officers (Sept. 10, sen. Aug. 13) L. J. Gilbert; (Sept. 18, sen. Aug. 27) J. W. Telfer; (Sept. 30, sen. Sept. 13) E. E. Smith. Flight Sergeants (Sept. 3, sen. Aug. 13) W. F. Howe; (Sept. 9, sen. Aug. 27) A. Round; (Sept. 14, sen. Aug. 27) A. R. Milton; (Sept. 19, sen. Aug. 27) A. T. Arnold; (Sept. 23, sen. Sept. 4) S. V. Perry; (Sept. 25, sen. Sept. 13) R. W. Searle; (Oct. 7, sen. Sept. 30) J. E. C. Cambden. Sergeants: (Sept. 21, sen. April 25) G. C. R. Ackrill; (Sept. 23, sen. Sept. 9) T. G. Davis.

Act. P/O. on probation F. N. Morris is graded as Pilot Officer on probation (July 4).

Equipment Branch.

Flt. Sgt. F. S. Abbott is granted a commission for the duration of hostilities as Pilot Officer on probation (Oct. 1, sen. Sept. 17).

P/O. on probation D. MacD. Jannaway is confirmed in his appointment (Jan. 23), and promoted to the rank of Flying Officer (May 20).

The undermentioned Pilot Officers on probation are confirmed in their appointment (Aug. 17) and promoted to the rank of Flying Officer:—(Sept. 6) G. D. Dillabough; (Sept. 8) B. P. Fortescue; (Oct. 17) T. J. da Casta Andrade, A. C. Bartrum, T. J. Goggin, A. A. G. Goodall, G. W. Stoddard.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(Aug. 28) F. B. King; (Sept. 4) A. H. Gee, M.M., M. J. Sullivan, G. W. Salt, F. E. Bastin, C. Stonebridge.

The undermenticned Pilot Officers are promoted to the rank of Flying Officer:—(July 3) J. H. Elhs, J. M. White, O. R. Toyne; (July 17) P. C. F. Morgan.

Accountant Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Acting Warrant Officer (Oct. 7, sen. Sept. 18) A. E. C. Russell. Sergeant (July 11, sen. June 6) E. A. Ray.

The undermentioned Pilot Officers on proba-

SERVICE AVIATION (CONTINUED)

EMPIRE TRAINING: Pupils at Trenton Air Base, Ontario, learning the secrets of the Browning machine gun.

SERVICE AVIATION (CONTINUED)

tion are confirmed in their appointments (Jun 10) and promoted to the rank of Flying Officer (July 31):—F. D. Pryce, E. F. Riddell.

The undermentioned Pilot Officers on proba tion are confirmed in their appointments (Jul 29) and promoted to the rank of Flying Officer:—(Sept. 3) H. R. Harman, S. Robinson; (Sept. 4) E. H. H. Caven, W. L. Hughes; (Sept. 7) J. S. Doughty, J. E. Nevitt, A. E. Ekins; (Sept. 18) I. I. Watkins.

F/O. R. W. Freeman (ret.) is promoted to the rank of Flight Lieutenant (temp.) (Sept. 4).

Medical Branch.

A. F. Baldwin, M.B., B.S., is granted a short service commission as Flying Officer for three years on the active list, and is seconded for duty in St. Bartholomew's Hospital (June 17).

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(Sept 4, sen. Sept. 4, 1939) L. W. Davies, M.B., B.S., M.R.C.S., L.R.C.P.; M. McLennan, M.B., Ch.B.: (Sept. 4, sen. Mar. 13) R. Maycock, M.R.C.S., L.R.C.P.

Princess Mary's Royal Air Force Nursing Service

Sister Miss G. J. Hawkins resigns her appointment (Oct. 21).

Royal Air Force Reserve

ROYAL AIR FORCE OFFICERS.

General Duties Branch.

Act. P/O. on probation J. R. Cherry is graded as Pilot Officer on probation (Sept. 19, 1939).

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—(Sept. 3, 1939) R. Benham (substituted for notification in *Gazette* of July 30); (Sept. 3) R. H. McIntosh, W. N. L. Cope, H. A. Crommelin, E. D. Crundall, D.F.C., D. A. Letts, D. A. Rea, G. Brembridge, A.F.C., E. A. Starling, T. E. Wesson, G. R. Mack, W. Hill, P. A. R. Brembridge, A. de V. Leach, E. Goldsmith, W. L. B. Palmer, H. A. Roxburgh, R. H. Weston, W. Miller, E. M. H. Slade, B. R. Tritc, L. W. W. Modley; (Sept. 10) D. C. Burnley, U. S. Mackay; (Sept. 25) F. C. Fisher; (Oct. 9) J. G. Hay; (Oct. 14) P. C. Hordern.

The undermentioned Flying Officers are transferred to the Administrative and Special Duties Branch:—(Oct. 10) E. N. Fenton, M. M. Kaye.

F/O. J. T. C. Hillman relinquishes his commission in class CC on appointment to a commission in the R.A.F.V.R. (Oct. 11).

F/O. on probation J. R. Cherry relinquishes his commission on account of ill-health (May 1) (substituted for the notification in the *Gazette* of June 18).

Administrative and Special Duties Branch.

F/C. A. Prescott is transferred to the Technical Branch (April 24).

Equipment Branch.

F/O. D. A. Watson is transferred to the Administrative and Special Duties Branch (Oct. 10).

ROYAL AIR FORCE VOLUNTEER RESERVE.

General Duties Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—(July 3) L. W. Thres, D.F.C., H. E. Oakshott; (Sept. 5) A. L. White; (Sept. 25) J. Procter; (Sept. 30) J. T. P. Joyes. Sergeants (Aug. 22, sen. Aug. 9) D. C. Spencer; (Aug. 31, sen. Aug. 24) H. W. G. Andrews, J. B. Maylam, G. S. Sumner, L. F. Edgar, H. W. F. Edwards, D. S. Edwards; (Sept. 6) H. C. Adams; (Sept. 7) S. G. Rodd, G. S. P. Bain, C. R. Fenwick, V. C. Lovell, A. A. Ballantine, P. L. Caldwell; (Sept. 14, sen. Aug. 26) L. H. Skinner; (Sept. 18, sen. July 30) J. L. Richards; (Sept. 21, sen. Sept. 14) J. F. Alexander, H. R. Rowntree; (Sept. 21, sen. Sept. 15) R. E. R. Adams, J. M. Betts, T. A. Bowen, D. H. Jeffery; (Sept. 21) R. C. Cussons, C. W. Dunnett, F. W. Leach, J. W. Carr, D. C. Maltby, A. Parker-Rees, F. A. Proctor, I. McT. Ramsay; (Sept. 22, sen. Sept. 21) L. N. Askew, J. J. Robinson, G. W. Varley; (Sept. 22) R. L. Rossiter, R. W. Trehern, T. Fairhurst, D. Leatherland; (Sept. 29) P. C. Birch, R. J. Hamilton, P. C. Brown, D. Morrison, W. W. McMaster, R. W. Miller, C. A. Ogilvy, R. H. C. Powling, J. C. Robson, W. G. G. D. Smith; (Oct. 1, sen. Sept. 18) C. W. C. Farrow; (Oct. 1, sen. Sept. 29) F. G. Land, W. B. Shimmons; (Oct. 2, sen. Sept. 29) D. C. B. Robertson, C. F. Counter, P. Haldenby; (Oct. 5, sen. Sept. 29) D. F. Knight; (Oct. 6) T. D. Condy. Leading Aircraftmen: (Sept. 8) J. C. Watson, L. W. Millet, S. A. Taylor; (Sept. 14) A. W. Farrell; (Sept. 21) E. J. Coutts, H. Tamblyn; (Sept. 29) H. E. Hooker. As Acting Pilot Officers on Probation:—(Aug. 23) L. Johnson, R. Mason, B. C. Meiklereid, G. A. Merriman, J. H. Rankin, J. R. Thomson; (Sept. 27) L. D. Britain, S. E. Hill, H. L. King, J. A. T. Longden, P. C. Moody, J. F. Philpott, G. F. Sellick, J. G. St. G. Syms, G. G. Waddington.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation. (July 20, sen. July 11) Sergeants: E. S. Few, A. H. Hull. (Substituted for notification concerning these officers in Gazette of Sept. 3.)

The undermentioned Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer:—(Sept. 18) R. T. Boyd, P. B. Elwell; (Sept. 21) A. Zweigbergk; (Sept. 27) L. O. Stocken, E. B. G. Masefield.

P/O. on probation C. H. Willis, A.F.C., is confirmed in his appointment, March 29, and promoted to the rank of Flying Officer (Oct. 16).

Act. P/O. on probation A. F. Harris is confirmed in his appointment and graded as Pilot Officer (Aug. 24).

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—(Sept. 3) N. M. Browning, C. H. N. L'Estrange, R. L. Bowes, G. G. McLannahan, G. F. Powell; (Sept. 4) L. J. C. Mitchell; (Sept. 9) M. R. MacArthur; (Sept. 17) M. F. Ogilvie-Forbes; (Sept. 18) C. H. Lewis, W. B. Thompson, J. D. Wood.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer:—(Sept. 3) L. H. Wood, M. G. Olley, R. A. Winter, E. T. Halley, S. W. R. Howell, G. Crawford; (Sept. 11) S. P. Russell; (Sept. 13) M. E. Burnham; (Sept. 25) T. W. Burrows, A. F. Houseman; (Sept. 26) R. McE. Mottram, J. G. I. Acheson, J. R. Button; (Oct. 3) J. A. Crompton.

Act. P/O. on probation E. L. Hartmen is transferred to the Administrative and Special Duties Branch (Oct. 12).

Balloon Branch.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—(Oct. 1) F. E. Webb. Corporals: (Aug. 21, Sen. Aug. 6) A. L. Rogers; (Sept. 15, Sen. Aug. 23) G. Hutchinson; (Sept. 15, Sen. Sept. 5) C. W. Stevenson; (Sept. 17, Sen. Sept. 5) W. R. White; (Sept. 29, Sen. Sept. 12) G. R. Fairs; (Oct. 4, Sen. Sept. 19) W. F. A. Snell. Leading Aircraftmen: (Sept. 23, Sen. Sept. 5) I. U. Carter; (Sept. 27, Sen. Sept. 17) F. W. Owens; (Oct. 1, Sen. Sept. 16) R. M. J. Hutchins. Aircraftmen 1st Class: (July 24, Sen. July 18) J. G. Talbot; (Sept. 16, Sen. Sept. 5) J. W. Clegg; (Sept. 22, Sen. Sept. 12) H. Willis; (Sept. 21, Sen. Sept. 4) J. A. Wise.

The undermentioned are transferred to the Administrative and Special Duties Branch:—(Oct. 10) F/O. C. F. Halford, P/O. on probation B. M. Davison.

Technical Branch.

P/O. on probation F. Ingham is confirmed in his appointment and promoted to the rank of Flying Officer (Sept. 29).

The undermentioned Pilot Officers on probation are confirmed in their appointments:—(Sept. 26) M. G. Scroggie; (Sept. 28) L. W. D. Pittendrigh, J. T. Bain, H. Andrewes, S. F. Evans, A. M. Hardie; (Sept. 29) E. W. Braendle, E. M. Eldred.

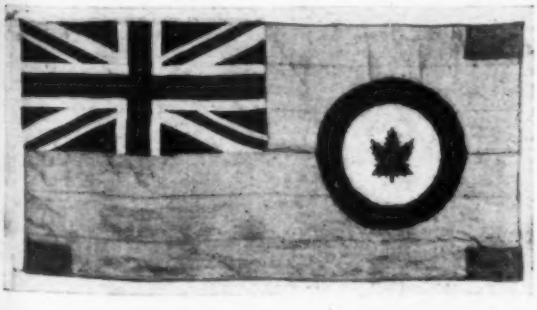
Administrative and Special Duties Branch.

The undermentioned are granted commissions for the duration of hostilities as Flying Officers:—(Oct. 1) G. J. H. Jeffs; (Oct. 11, Sen. Dec. 19, 1938) J. T. C. Hillman.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—Sergeants: (Aug. 4, Sen. July 16), A. Lever; (Aug. 26, Sen. Aug. 21) B. Lucas; (Sept. 19, Sen. Aug. 26), A. W. J. Cornwell; (Sept. 26, Sen. Aug. 29) R. J. Bond. Corporals: (Sept. 15, Sen. July 31) F. S. C. Simmons; (Sept. 30, Sen. Aug. 16) H. P. Birchenough. Leading Aircraftmen: (July 5, Sen. April 25) L. I. Stringer-Jones; (Aug. 31, Sen. Aug. 23) P. J. Burlow; (Sept. 19, Sen. Aug. 6) O. C. Payne. Aircraftman 1st Class: (Sept. 25, Sen. Aug. 27) G. H. Wright. Aircraftman 2nd Class: (Sept. 26, Sen. Aug. 16) C. R. Stokes.

The undermentioned are granted commissions for the duration of hostilities as Pilot Officers on probation:—(Dec. 6, 1939) J. M. R. Jayakar; (June 27, O. W. Crichton; (June 28) D. A. Burgess, R. F. Gwyn; (June 29) D. C. Breton, F. J. H. Royle; (July 1) J. H. Franklin-Smith, W. S. Howe, H. M. Leapman, J. Smith, J. L. Downey; (July 2) A. Newman, H. B. Way; (July 3) C. W. Thomas; (July 5) E. O. Gordon, A. A. F. T. Steavenson; (July 6) A. Harvey; (July 13) R. H. Eliott, D.S.O.; (July 15) H. E. Blaiberg; (July 17) J. J. Bayley; (July 18) N. N. E. Bray, W. Lyng; (July 19) M. R. T. Roussel; (July 22) V. C. Hollender; (July 23) W. Chadwick, H. B. Owden; (Aug. 12) A. P. Dyke; (July 23) H. N. Roffey; (Aug. 19) W. B. Cass; (Aug. 22) R. J. Bateman, G. E. P. Bouch; L. C. Horsler, J. J. Secter; (Aug. 23) F. B. Taylor; (Aug. 26) H. J. Gray; (Aug. 27) G. S. Parker; (Aug. 29) R. A. Cook, A. T. Williamson; (Aug. 30) W. Foster, W. Whittle; (Sept. 3) G. H. G. Cattell, C. M. Manson; (Sept. 6) H. Cross, W. A. W. Lankshear, R. J. M. Lloyd-Jones, F. J. MacRae, S. McAughey, J. F. H. Naylor, G. Niven, J. E. Ongley, P. J. Rossington, J. Schofield, A. Dumbill; (Sept. 9) L. G. Bremner, J. Gilbert, F. E. Wilson; (Sept. 10) R. F. Allen, G. V. Constant, P. J. Tytherleigh; (Sept. 13) A. M. Allen, N. C. E. Ashton, C. A. Baker, F. A. Baker, R. R. Barber, L. R. Bell, K. B. Berry, J. Black, J. R. M. Bond, J. D. Bower, B. H. Brear, J. R. Burges, R. A. Collacott, N. E. Copley, C. Craven, W. Dickinson, F. Downs, G. R. Dryden, H. P. T. Eriksson, J. H. Evans, L. S. Fisher, E. C. Forsyth, W. J. Hamilton, J. R. Hazell, M. G. T. Hewlett, N. J. Highwood, J. H. James, J. Kennedy, K. B. Lalonde, K. S. Lockie, P. J. Marsh, C. W. Milburn, C. E. B. Murrell, J. G. Parks, E. H. Peet, A. M. Piggin, E. A. Powrie, G. W. P. Ryan, R. Shillcock, E. H. Sneath, M. S. Straker, G. B. Strang, H. M. Tudor, C. H. Wallis, K. B. Willis, G. Stables; (Sept. 16) R. T. Hill, R. W. A. Richards, I. S. Quayle; (Sept. 18) E. H. Bland, F. C. Clarke, W. H. Davis, G. D. Monteath; (Sept. 19) J. Allden, M.C., W. V. Brooks, M.C., I. MacDonald, H. C. Rendall-Stevens; (Sept. 21) F. B. S. Grimston, J. A. Lawrence; (Sept. 22) G. R. S. Charles, W. K. Walker; (Sept. 23) R. A. Barnett, R. Benson, D. N. B. Cornwell, K. F. Jones, W. E. McLean, R. A. Raleigh; (Sept. 24) P. C. Balcon; (Sept. 26) G. Whitehead; (Sept. 27) B. G. Barnett, H. W. Goodrich, C. Pengelly; (Sept. 28) A. H. Bibby, A. T. Goodman, W. C. Marshall, E. H. May, H. W. Norman, A. P. Smith, F. W. Wilder; (Sept. 29) H. L. Collingbourne, C. W. R. Shubrook, H. W. Shuker, S. Nixon, S. A. Strange, G. M. Williams; (Sept. 30) H. W. Allen, F. L.

MORE EMPIRE TRAINING: Pilot pupils at the Elementary Flying Training School at Narromine, Australia. They will go to Canada for advanced training.



THE R.C.A.F. ENSIGN: The base is sky blue with a Union Jack in the corner. The roundels are dark blue and white with a red maple leaf in the centre.

SERVICE AVIATION (CONTINUED)

Atkinson, E. W. S. Bardsley, J. G. B. Draper, A. E. Fournier, S. G. Knock, A.F.C., R. M. Rickett, T. I. Scott, A. E. Seymour; (Oct. 1) H. S. Ball, L. M. Grigson-Page, G. B. Pulling, H. H. Smetham; (Oct. 2) S. C. Baron, S. L. Goodman, C. F. Nicholson, J. H. Welsby; (Oct. 3) E. W. Doig, F. G. Hopkins, J. K. Lancaster, J. D. S. Nowell, G. H. Rountree, K. R. Upright, J. M. Woodcock; (Oct. 4) A. B. Howe, G. W. Knights, P. S. Williamson.

N. G. Bennett is granted on hon. commission as Flight Lieutenant (Oct. 15).

The undermentioned Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer:—(Aug 28, 1939) S. Barraclough, F. S. Bloomfield, G. G. Edwards, E. T. Symonds; (Sept. 9, 1939) B. J. Lynch; (July 25) W. Mellor.

The unlermentioned Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer:—(Sept. 3) F. Hoult; (Sept. 7) T. H. E. Edwards; (Sept. 8) G. U. Cuddon; (Sept. 9) G. A. Carr, W. Paterson, B. J. Lynch; (Sept. 19) H. R. Clay, B. Le B. Musgrave, A. A. McConnell, C. F. Smith; (Sept. 26), F. C. Lill, G. de Jongh, W. Parkinson.

P/O. E. A. Huntington-Whiteley is promoted to the rank of Flying Officer (Sept. 23).

The undermentioned Pilot Officers on probation are confirmed in their appointments:—(Sept. 5) H. V. Campbell, J. Wilkinson; (Sept. 7) E. T. Beer; (Sept. 8) The Hon. G. C. S. P. Butler; (Sept. 9) C. P. Andrews, E. F. Briggs, E. J. N. Brown, W. G. Dreschfield, T. Harris, G. B. M. Reed, E. D. Tiddy, J. L. Trollope; (Sept. 13) C. G. Slade; (Sept. 16) E. A. Huntington-Whiteley; (Sept. 19) H. G. Sullivan; (Sept. 21) R. A. Wyatt.

The undermentioned Acting Pilot Officers on probation are graded as Pilot Officers on probation:—(June 10) H. G. Tomkins; (June 26) G. L. D. Cox; (July 4) W. A. O'M. S. Brayton, R. N. Walford; (July 18) R. W. O'Farrell; (Aug 5) C. Bartlett; (Aug. 24) R. W. Nyreu, R. F. T. Paterson; (Sept. 2) A. D. Snowden.

P/O. on probation H. E. Hervey is transferred to the General Duties Branch (Oct. 3).

Hon. Sqn. Ldr. G. J. H. Jeffs relinquishes his hon. commission (Oct. 1).

Hon. F/O. N. G. Bennett relinquishes his hon. commission (Oct. 15).

P/O. on probation E. H. S. St. Leger-Barter relinquishes his commission on account of ill-health (Oct. 22).

The commission of P/O. on probation J. H. Franklin-Smith is terminated on cessation of duty (July 6).

Erratum.

In the Gazette of July 30, for E. O. Levers read E. O. Ievers.

Equipment Branch.

J. D. Morris is granted a commission for the duration of hostilities as Act. Pilot Officer on probation (Sept 6).

P/O. on probation E. C. Davey is confirmed in his appointment and promoted to the rank of Flying Officer (Sept. 18).

The undermentioned Acting Pilot Officers on probation are graded as Pilot Officers on probation:—(June 19) J. H. Becker; (June 20) J. E. C. Botham; (July 22) K. Slingsby-Fahn; (July 24) D. S. G. Coram, R. Efstathiou, W. A. Howitt, E. L. Murrell, W. W. Stabb; (July 25) H. Rothwell; (July 26) R. V. Coulson-Dunn; (July 29) R. C. S. Bevan.

Accountant Branch.

Sgt. F. D. C. Hall is granted a commission for the duration of hostilities as Pilot Officer on probation (Oct. 1, Sen. Sept. 18).

Cpl. C. G. A. Fripp is granted a commission for the duration of hostilities as Act. Pilot Officer on probation (July 24, Sen. June 24).

The undermentioned Pilot Officers on probation are confirmed in their appointments, Sept 11, and promoted to the rank of Flying Officer:—(Sept. 27) H. J. Binder; (Oct. 3) W. S. McCallum.

P/O. on probation K. E. Young is confirmed in his appointment, Sept. 1, and promoted to the rank of Flying Officer (Oct. 10).

The undermentioned Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer:—(Sept. 6) E. P. Wilkinson; (Sept. 15) R. Beal, A. N. Bentley.

The undermentioned Acting Pilot Officers on probation are graded as Pilot Officers on probation:—(Aug. 5) R. Boughey; (Aug. 29) A. R. Wesley, J. M. Bailey, R. W. Goodburn; (Aug. 31) G. M. D. Drummond, A. E. Brown.

Medical Branch.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(Sept. 19) R. T. Goodyear, M.R.C.S., L.R.C.P.; (Sept. 21) N. Jackson, M.B., B.Ch.

F/O. N. E. Stidolph, B.M., B.Ch., is promoted to the rank of Flight Lieutenant, Aug. 29. (Substituted for the notice in the London Gazette of Oct. 8.)

F/O. L. O'N. Knox, M.R.C.S., L.R.C.P., is promoted to the rank of Flight Lieutenant, May 9. (Notification concerning this officer under the heading of Auxiliary Air Force in the *Gazette* of Oct. 8 is cancelled.)

Dental Branch.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(Sept. 18) S. W. Pearks, L.D.S., B. E. Greenfield, L.D.S.; (Sept. 22) L. E. Slaney, L.D.S.; (Sept. 26) J. E. M. Bond, L.D.S.; (Sept. 28) J. Costelloe, B.D.S.; T. M. Joyce, B.D.S.

Chaplains' Branch.

The undermentioned are granted commissions for the duration of hostilities with the relative rank of Squadron Leader (Oct. 8):—The Rev. H. A. Cosgrove, The Rev. J. Finlayson, B.A., The Rev. E. D. O'Neill.

Auxiliary Air Force

General Duties Branch.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant:—(Sept. 3) G. M. Gardner, S. J. Harrison, M. G. L. Foster, J. C. G. Bell, W. H. McGiffin, M. L. Edwards, J. Alexander, P. M. V. Lysaght, R. O Rhys; (Oct. 14) G. Henderson.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer:—(Sept. 3) E. N. Harris, J. G. Lane, A. P. B. Holmes, A.A.F.R.O.; (Sept. 16) G. A. B. Johnston.

Balloon Branch.

The undermentioned Pilot Officers are promoted to the rank of Flying Officer on the dates stated: (Sept. 3) E. Errington, M.P., K. G. Kent, T. G. M. Weldon, A. B. Ford, S. W. Messenger, A. G. Matthew, J. G. Kellock, A. M. D. Pitt.

The undermentioned Flying Officers are transferred to Administrative and Special Duties Branch (Oct. 10):—L. T. Rye, G. Coppock, J. R. P. Mitchell.

Administrative and Special Duties Branch.

P/O. J. P. Mills is promoted to the rank of Flying Officer (Sept. 3).

P/O. on probation J. E. Lloyd is confirmed in his appointment and promoted to the rank of Flying Officer (Sept. 5).

Medical Branch.

F/O. A. L. Cowan, M.B., Ch.B., is promoted to the rank of Flight Lieutenant (Aug. 26).

Auxiliary Air Force Reserve of Officers

General Duties Branch.

The undermentioned Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—(Sept. 3) R. J. Holland, J. H. Smith; (Sept. 30) C. W. Rees.

Women's Auxiliary Air Force

The undermentioned are appointed Assistant Section Officers on the dates stated:—(Sept. 24) A/CW.2 Mrs. J. V. Cooper, Cpl. Miss V. M. R. Marsden, A/CW.2 Miss J. Starling; (Oct. 12) A/CW.1 Miss A. K. J. Bosanquet, Cpl. Miss F. F. Boyle, A/CW.1 Miss M. M. Gregg; A/CW2 Miss A. H. S. Henderson, Cpl. Miss E. C. Henderson, A/CW.2 Miss B. I. Jefferson, Cpl. Miss I. M. Knott, A/CW.1 Mrs. M. K. D. Lilburn, A/CW.2 Miss D. Marsh, A/CW.1 Miss P. M. Massie, A/CW.2 Miss J. E. H. Powell, Cpl. Miss E. M. Viner, A/CW.1 Miss H. White, A/CW.1 Miss H. E. Willink; (Oct. 13) A/CW.1 Mrs. B. A. Corrigan, Sgt. Miss M. S. Philip, Sgt. Mrs. M. M. Thomson.

Assist. S/O. Mrs. P. M. Bateman relinquishes her appointment Oct. 10.

Erratum.

In the London Gazette of June 11 notification concerning A/CW.2 Miss E. B. Morton-Roberts *read* Miss E. B. Roberts.

OPERATIONAL TRAINING UNIT: Sqn. Ldr. P. Townsend, D.F.C.—in centre with stick—still remains on duty despite a foot wounded by a cannon shell. Among his pilots are two Frenchmen, two Poles, a New Zealander and one from Nigeria.

Air Strategy—XXVI

FOR THE LONG-RANGE BOMBER—

—Reorganise the Servicing Side of the R.A.F.

By CAPTAIN NORMAN MACMILLAN, M.C., A.F.C.

BRITAIN'S greatest need at the present time and in the immediate future is for long-range bombers. Five years have passed since I first advocated an Empire policy of defence by long-range bombers stationed in area zones; this would ensure that every zone could be reinforced from contiguous zones without delay. That proposal meant the creation of a really long-range bomber. Five years ago I gave as its required performance a minimum range of 3,000 miles, cruising speed 250 miles an hour and load two tons of bombs at full operational range.

What a blessing it would have been to have possessed such a bomber, zoned all over the Empire, at the outbreak of the war. The establishment of aerodromes with ground crews, and the siting of spares and all repair requirements within each zone would have facilitated the free movement of such aircraft in response to emergency demands; for it is not the passage of aircraft which hampers air reinforcement, but the cumbersome paraphernalia of all the ground detachments.

The specialised ground equipment of the Royal Air Force is unknown to the average personnel of the Navy and the Army, the two Services generally responsible for terrestrial transport. This can increase the difficulty of moving air reinforcements to a much greater extent than ought to be the case. It appears to me that it is essential that nothing should be allowed to stand in the way of the swift air reinforcement of any part of the Empire which may require it. The traditional rôles of the Navy and Army in handling terrestrial transport cannot be permitted to become obstacles in the way of the most rapid movement of squadrons in an operable condition. To send squadrons without ground servicing personnel accustomed to the types of aircraft they will have to service is not calculated to create efficiency.

Esprit de Corps

During the last war the squadron unit grew up to maturity. And squadrons developed an *esprit de corps* of their own. The numerous dinners of Great War squadrons which were held year after year during the period of uneasy peace testify to that spirit. But aviation has long since passed that stage. To-day an air squadron has as much significance in war as has a troop of cavalry. The squadron unit is too small now for the type of work that has to be done, for it binds into too close a relationship a small body of pilots and flying crews with a particular group of men engaged on the ground duties. Separate the two—the flying personnel and the ground personnel—and the squadron as at present organised has lost in efficiency immediately.

The establishment of base personnel at aerodromes to service aircraft stationed there from time to time is, perhaps, not the best way out of the difficulty, for the personnel on ground duties then lose their direct contact with the flying personnel through association with a squadron. The difficulty is not lessened by the fact that tactically the squadron is a handy unit in flying operations. So it is not altogether easy to suggest a way out of the difficulty in wartime which does not bring other difficulties in its train.

I do not think the German method of organising in squadrons, groups and regiments is suitable for the requirements of the British Royal Air Force. It was a good method to adopt for a closely centralised Germany, but that does not make it a good method for a far-flung Empire which is composed of many detached units of territory governed under a variety of conditions.

What I personally think is the best way to get over the difficulty is to create a new form in the fabric of the Royal Air Force in which the flying personnel is acknowledgedly separate; so that the aircraft and their crews form a tactical unit able to be moved anywhere within certain predetermined limits which, in turn, will depend upon the possession and equipment of prearranged and fully equipped bases.

The ground personnel, on the other hand, organised in brigades, battalions and companies, or some other suitable nomenclature, would be grouped as, say, No. "X" Bomber Brigade, Battalion or Company. The word "bomber" could be substituted by the word "fighter" or "army co-operation" or "coastal" or "training," and so on, in accordance with the training and composition of the particular ground unit.

Specialisation

With ground personnel grouped into units of this kind, each unit would be trained to service particular types of aircraft. There would be the minimum misfitment of ground personnel. And if, say, a Wellington squadron were required to be despatched to operate somewhere on a new front, instead of drawing a hotch-potch batch of personnel from some pool, or trying to make shift with its own ground personnel at both stations at once, it would be necessary only to despatch, a sufficient time in advance, a unit from a Royal Air Force (Wellington) Bomber Brigade to the new site so that an efficient unit was already there to handle the aircraft when they arrived. The *esprit de corps* of the ground personnel would be created around the brigade or battalion to which they were attached, and the work of all the squadrons using the types of aircraft handled by the brigade during its history would be woven into the spirit of allegiance to the brigade unit.

In the Royal Air Force there is and has been too much worship of the machine, the actual aeroplane, instead of pride in the body corporate. In a way this is natural, for the actual aeroplane is in some peculiar way the symbol of the squadron. I believe that the ground personnel would get a far more worthy share of the honour which is due to their work if they were organised in separate units instead of being part and parcel of the flying unit. The work of the ground battalion or brigade would be recognised individually, as was the work of the infantry in relation to that of cavalry. And in air war to-day, ground personnel are in the line in a way which did not apply in Great War I.

A further advantage which would accrue from the separation of the flying and ground personnel into distinct units would be that Naval and Army methods could be more closely followed in the organisation of ground units; this would assist the Navy and Army in the work of transporting the ground personnel of the Royal Air Force. Moreover, it would make it easier to interchange some of the ground personnel between the Services for training in each other's methods, and

FOR THE LONG-RANGE BOMBER (CONTINUED)

thus make their co-operation in war tend to work more smoothly.

The outlook upon the present war is that it must be a long uphill fight. For it does not appear that by any other road can we make up for the shortcomings of the years that "the locusts" ate. So there is time to organise in the most effective manner for that uphill road. It is of no use to say that we cannot reorganise in wartime. We shall have to if we are going to survive what lies ahead. Nothing, absolutely nothing, must be allowed to stand in the way of victory. And the most certain way to victory is to follow in the air the bold direct tactics which Nelson followed more than a century ago upon the sea—bold direct attack; hit, hit, hit.

To do that we need bases, adequately defended, adequately equipped (and by adequately equipped I do not mean that the works and buildings department has to get busy as it did in the years of tardy rearmament before the war and spend millions of money in putting up palatial quarters and hangars which make marvellous bombing targets). The equipment required must be built in accordance with the fact that the Royal Air Force is fighting in the front line. There should be as much relationship between a wartime and a pre-wartime aerodrome as there is between a military outpost in war and a country club in peacetime.

The great hangars that were erected all over England between 1936 and 1939 were designed and built without the slightest conception of their suitability for resisting air bombardment. Often they were placed in rows so that several buildings were all in strategic bombing lines. And millions of pounds of public money were built into these lovely country sites, as though the peace would last for ever. It will be interesting to know how they all fared when the end of the war permits the full story to be told. Anyhow, that stage of luxury peacetime building for the Royal Air Force is over for the present. Blast and splinter proof, if not direct bomb proof shelters for aircraft and personnel are more important on a wartime aerodrome to-day than all the lovely buildings that ever were visioned in the dreams of an architect.

Two Sections

With an air force organised into two great sections—a section built up of tactical flying units, and a section built up of administrative and servicing personnel—there would be the minimum of time wasted in training. Specialists could be employed in each section. It would not be necessary for either to overlap. A flying officer would not be taken off his flying duties to carry out other work. When he was not flying he could rest, or visit the Army or Navy units with which his own unit had to co-operate. Similarly, the ground personnel would be specialists. There would be no need to waste their time learning things that were not necessary to their real duties.

When new types of aircraft were about to be introduced into service, units of a ground brigade could be withdrawn for training in the new types, and their places filled from reserve units. Moreover, it would be possible under this type of organisation to withdraw front line ground personnel at intervals for a period of rest, as is customary in the Army.

It seems to me that the time has come to reorganise the Royal Air Force on lines such as these, so that the ground work is handled by units created for that purpose, irrespective of the squadrons they have to service.

With the present system it will not be possible to get real interchangeability between war zones to provide swift and adequate (as well as efficient) reinforcement of one area from another unless and until the stage is reached in staff work which visualises the movement of the slowest item in the whole outfit first.

Now, with an air force organised on the lines that I have suggested, it would become possible for the air staff to despatch from the reserve brigades, without delay, complete units of ground personnel, covering all the requirements of squadrons when operating in the field. These reserve units would have their own officers and non-commissioned officers. They would be accustomed to working as units, and they would be able to handle the maintenance of squadrons operating in the field efficiently. They would in time possess *esprit de corps* because they would be an organised body of men known to one another both up and down the scale of ranks.

That would be far more productive of good results than a method (or lack of it) which scrapes men together from a pool, or a reserve station, or from several stations in emergency to make up a unit of sorts to proceed to a new area. How could the Army function if its units were got together in this way? There would be poor discipline; no loyalty to regiment; no tradition. Why then should the R.A.F. function satisfactorily under a method which the Army would deplore?

Ambitious

I began this article by saying that our greatest need to-day was for long-range, high-speed bombers. The specification I suggested five years ago is now too modest. We ought to add 2,000 miles to the range, 150 miles an hour to the cruising speed, and three tons to the bombs. That means that we ought to be within measurable sight of a bomber able to cruise 5,000 miles at 400 miles an hour carrying five tons of bombs over its operational range of action. [Any offers from designers?—Ed.]

With such aircraft it is obvious that it is hopeless to despatch servicing personnel about the world by the old-fashioned forms of transport. It may be useful for special occasions (indeed, it certainly will be useful) to transport specialist personnel by air, and there ought to be transport aircraft for that purpose. But, to maintain the efficiency of long-range bombers, as well as the shorter-range aircraft which are still needed for area work, it is beyond question essential to have highly trained ground personnel at all key points, and to be ready to send further trained personnel to such additional points as the probable course of the war may indicate. And it is far better to have all the necessary ground personnel organised in advance into complete units than to have to sort them out at the last moment, as though they were loose pieces of a jig-saw puzzle lying higgledy-piggledy in a box, known to be there but waiting to be sorted out to make them into a proper picture. Even when the picture is complete in the latter case, the elements of which the outfit is composed cannot be expected to have the same cohesion and quality as a well-balanced unit which has been organised and officered and trained for weeks or months in advance as a battalion or brigade.

The reader may well ask why I deem such a radical change in the construction of the Royal Air Force to be necessary in war, a time when it is usually thought that changes are better avoided? For answer I say—

FOR THE LONG-RANGE BOMBER (CONTINUED)

Look at the map. So far, the longest average operating range of British bombers has been only some 600 miles; in a few instances, as, for example, the raids on Oslo and Trondhjem aerodromes in Norway, the range was slightly greater, but not much greater. Six hundred miles is about the average longest distance flown over Germany and Italy from British bases.

That means that unless range is increased the whole of Italy south of a line between Genoa and Venice is out of range from Britain. North from Italy the range curve includes Salzburg, Prague and Stettin, but little territory east of any of these places. If we discount Malta as a secure base for bombers (and so far it has not been so used), the next base is in the neighbourhood of Alexandria. From Alexandria the average range of operation reaches Athens, but not Istanbul. Indeed, Istanbul is outside the range of this average operational action from any base, even the nearest base in Palestine. Even if we had bases in Athens and Istanbul (which we have not) bombers giving us only this range would still leave a great space in Central and Eastern Europe outside the reach of Britain's bombers. This is not good enough.

We may dominate the seas, but that to-day is not enough. We must dominate the land as well, and we do not do so. We shall not be able to dominate the land until we possess bombers which can reach out to the uttermost corners of the earth, from the bases we possess. And we cannot win this war until we are able to straddle the whole of Europe from the air.

That means range and speed. And it means, too, a new organisation for the ground personnel of the R.A.F. That is why ground personnel is important in future air strategy. It may become the limiting factor. It is a pity that my outline of a policy for inter-Empire defence by long-range bombers with area zones was filed by complacent officials in Whitehall five years ago and presumably forgotten. For had that scheme been put in hand we could have reinforced every part of the Empire swiftly, and we could have bombed every hole and corner on the continent of Europe from the very outset of this war.

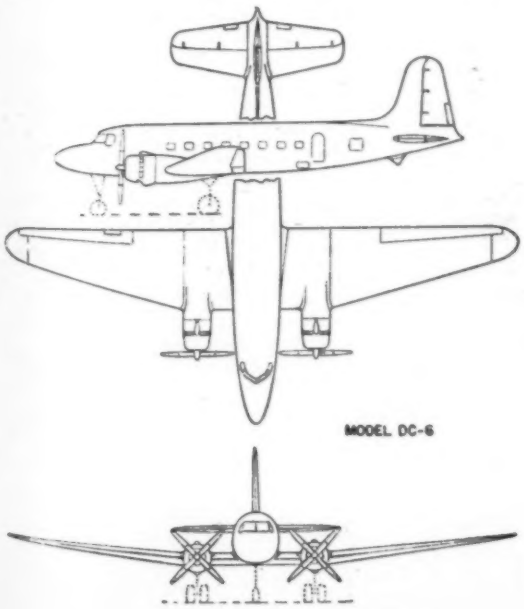
ANOTHER DOUGLAS

The DC-6 Civil Transport Announced : A Big Twin

PARTICULARS have been released of the latest civil Douglas, a large twin-engined transport powered with Wright Double-Row Cyclones of the R-2600 type of about 1,700 h.p. As might be expected, it is a low cantilever monoplane with nosewheel undercarriage. Unlike the DC-5 it is low wing, the DC-5 being the only Douglas model to be designed with a high wing.

The undercarriage is, of course, retractable with the main wheels consisting of two pairs of N.A.C.A. wheels rising into the nacelles. The nosewheel is fully retractable and enclosed by a door. It is steerable by the pilot when on the ground.

Its gross loaded weight of 32,000 lb. as a passenger carrier shows it to be a large aeroplane and it is only lately that it has become possible to build aircraft of this size powered by two engines. But its high wing loading of 32.2 lb./sq. ft. keeps dimensions down and its span is actually three feet smaller than a DC-3 which has a span of 95ft. and a gross loaded weight of 24,400 lb.



MODEL DC-6

Wing construction is of the all-metal cellular multi-web form with detachable outer panels incorporating watertight flotation compartments. The wing tips also are removable. The fact that the line drawing shows four-bladed airscrews should not necessarily be taken as proof that the aeroplane will be so fitted when it appears. The fuselage is all-metal semi-monocoque with transverse frames and longitudinal stringers. Flush riveting has been adopted.

The single fin and rudder is of usual Douglas proportions and the tailplane is cantilever. The fixed surfaces are all-metal but the control surfaces are fabric covered.

Passengers or Cargo

The pilots' compartment is forward of the wing and is reached through a corridor from the passenger cabin. The cabin provides daytime accommodation for 24 or 32 passengers, or 16 sleeper berths at night. At the rear of the cabin are buffet and lavatory. Cargo and baggage compartments which are forward and aft of the cabin and in the belly of the fuselage have a total capacity of 390 cu. ft.

As well as being a passenger transport, the Douglas DC-6 can act as a cargo transport and in this version has the increased gross weight of 33,500 lb. A volume of 1,636 cu. ft. is available for the cargo, as well as a floor area of 265 sq. ft. Loading is through a large door located near the rear of the main cargo compartment.

Empty weights for the 24 and 32 day passenger, 16 sleeper and cargo versions of the Douglas DC-6 are 21,216 lb., 21,083 lb., 22,164 lb. and 20,529 lb. respectively. For the passenger type the power loading is 9.4 lb./h.p. with wing loading 32.2 lb./sq. ft. Span is 92ft., length 72ft. 10in., height 27ft. and wing area 993 sq. ft.

It is stated to have a maximum speed at 14,500ft. of 274 m.p.h. and a cruising speed at 14,000ft. of 246 m.p.h. Landing speed is 75 m.p.h.; initial rate of climb on sea-level take-off power, 1,805 ft./min.; service ceiling, 28,000ft.; range at 10,000ft. at 60 per cent. rated power, 1,784 miles.

THE INDUSTRY

S.B.A.C. Officers, 1940

The Council of the Society of British Aircraft Constructors has unanimously re-elected the present office-holders for a further term. They are: President, Mr. F. S. Spriggs; Vice-president (Aircraft), Mr. A. Dunbar; Vice-president (Engines), Mr. H. J. Thomas; Honorary Treasurer, Mr. R. H. Dobson.

Trigonometrical Ratios

THE National Institute of Engineering has produced a tutorial service card entitled "Useful Trigonometrical Ratios." This shows clearly by diagram and formula the numerous trigonometrical relationships which exist between the sides, angles and areas of triangles. Its size is 11in. by 8in. It may be useful to draughtsmen in engineering offices and the Institute states that copies may be obtained free by application to the National Institute of Engineering, Department 39, 148, Holborn, London, E.C.1.

Canadian Consideration

STERNOL, LTD., the industrial and motor oil concern, have received the following message which accompanied an order from one of their customers in Ontario, Canada:

"Knowing full well the conditions you must be operating under, we are giving you ample time to make delivery within a reasonable time.

"Our sympathy and prayers go out to all you brave and courageous people. We are with you tooth and nail to the last dollar.

"Good luck and may God protect you all."

B.E.N. Vacuum Relief Valve

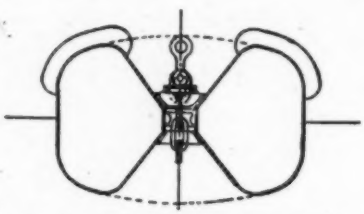
MANY firms employing vacuum vessels or receivers find it necessary to vary the degree of vacuum from time to time. The most effective method is by fitting an adjustable vacuum relief valve, and B.E.N. Patents, Ltd., of High Wycombe, have produced a valve specially designed for this purpose. The B.E.N. adjustable vacuum relief valve can be readily set to maintain a vacuum at any figure required from 4in. to maximum. The valve is extremely sensitive and the necessary adjustments to determine the vacuum at which it operates are easily and speedily made. The system on which this valve operates can be briefly described as follows:—

The valve incorporates a piston which is held in position by an adjustable spring. When a predetermined degree of vacuum is reached the resistance of the spring is overcome and the movement of the piston exposes two ports through which air is admitted to the vacuum vessel. As soon as the vacuum is established at its correct value the piston reseats in its original position. Settings providing an infinitely variable degree of vacuum can be secured by adjusting the tension of the spring. The valve is a sturdily constructed item of equipment and, apart from the phosphor bronze spring, gunmetal is employed throughout, thus resisting corrosion.

Further particulars are available from B.E.N. Patents, Ltd., Hughenden Avenue, High Wycombe, Bucks.

A New Mooring Buoy

THE Lambert-Garland mooring buoy has such obvious advantages that it is surprising that it has not been produced many years ago. Its principal feature is the employment of double cone frustrums with a special cable supporter and shackle eye. The conical frustrums save wear on the mooring cable and, since the cable is free to take up any desired angle within limits, the buoy remains level under load.



The Lambert-Garland Buoy of the type suggested for mooring aircraft.

The actual flotation tank of the buoy can, of course, be of any size or shape, the advantage lying with the arrangement of the central hawsepipe. For flying boat moorings it is suggested that a rounded top and bottom, soft fendered, reversible buoy is employed.

William McNeil and Co., Ltd., 125, West Regent Street, Glasgow, C.2, have been appointed the agents for the Lambert-Garland buoy in Great Britain.

Dimpling and Riveting

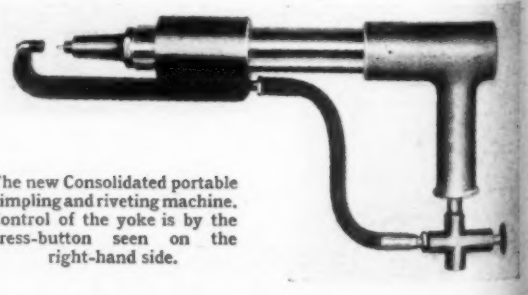
IN many aircraft assembly operations it is difficult to make use of a standard type of flush riveter, and a portable machine which could be taken to the work would be of great advantage in speeding up production. The new Consolidated portable machine illustrated was produced for a specific instance of this kind and is now being produced as a special type for use particularly where access for riveting is greatly restricted.

Both dimpling of the sheets and closing of the rivets can be carried out with this machine. Its operation is based upon that of the same firm's one-shot riveting gun, a special form of which is incorporated. A press-button valve mounted below the handle controls the opening of the yoke. Pressure upon the button exhausts air through a flexible pipe from a feed cylinder which slides upon the barrel of the riveter. The yoke is formed integrally with the cylinder and opens under the action of an internal return spring. With the yoke extended the riveter can be placed in position over the work.

By releasing the button air is admitted to the feed cylinder and closes the yoke by overcoming the action of the return spring. Pressure on the handle then admits air behind the hammer piston and brings it down with one sharp blow on to the rivet set or dimpling tool. The weight of blow can be controlled by means of a knurled-head screw which allows for a very sensitive adjustment.

Dimpling tool and rivet set are interchangeable in the nose of the machine. Yokes are obtainable having a throat depth up to 6in., and special types can be supplied to suit individual requirements. The machine has an overall length of 16¾in., with a weight of 6lb., and will close rivets up to $\frac{5}{32}$in. in diameter.

The Consolidated Pneumatic Tool Company, Limited, 232, Dawes Road, London, S.W.6, are the makers.



The new Consolidated portable dimpling and riveting machine. Control of the yoke is by the press-button seen on the right-hand side.

NEW COMPANIES

BERNARD SUNLEY AND SONS, LTD.—Private company. Registered October 10. Capital £10,000 in 10,000 shares of £1 each. Objects: To construct, develop, manage and control railways, tramways, gas and electricity works and aerodromes, and to carry on the business of civil, electrical and general engineers, metal and alloy makers and workers, paviors, tar spraying and asphalt contractors, cement and concrete contractors, etc. The subscribers (each with one share) are: Nancy M. Grundy, 9, Barnfield Road, Belvedere, Kent, solicitor's clerk; Joan R. Newman, 13, Arbuthnot Road, New Cross, S.E.14, solicitor's clerk. Bernard Sunley is permanent governing director. Qualification: 100 shares. Remuneration (except managing directors) as fixed by the company. Solicitors: Kenneth Brown, Baker, Baker, Essex House, Essex Street, W.C.2.

LAZGILL AIRCRAFT, LTD.—Private company. Registered October 12. Capital £500 in 500 shares of £1 each. Objects: To carry on the business of aircraft engineers, manufacturers of aircraft of all kinds and instruments used in connection therewith, aircraft components, etc. The subscribers (each with one share) are: Herbert C. Wisenden, 10, Dinsdale Court, Great North Road, New Barnet, solicitor's clerk; Albert E. Mirow, 9, Becmead Avenue, Kenton, Middlesex, solicitor's clerk. The directors are Hyman Lazarus (permanent governing director) and Crawford A. Gilmour, addresses not stated. Solicitors: Zefferti, Heard and Morley Lawson, 17, Coleman Street, E.C.

INCREASE OF CAPITAL

BICKERTON'S AERODROMES, LTD.—The nominal capital has been increased by the addition of £13,000, in £1 ordinary shares, beyond the registered capital of £7,000.

PUBLICATIONS RECEIVED

Gears and Gear-cutting, edited by F. J. Camm; 5s., George Newnes Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

The Observer's Book on Dead Reckoning Navigation, by W. J. D. Allan and W. Alexander; 2s. 6d., George Allen and Unwin Ltd., 40, Museum Street, London, W.C.1.

Arctic Pilot, by W. Gilbert as told to Kathleen Shackleton; 7s. 6d., Thomas Nelson and Sons Ltd., 35-36, Paternoster Row, London, E.C.4.